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Where are we after 60 years of paragonimiasis research? A bibliometric assessment

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SUMMARY

Paragonimiasis is highly prevalent endemic foodborne disease in Southeast Asia and Latin America, and constitutes a major public health concern. A bibliometric analysis was performed about the worldwide scientific production of paragonimiasis. We browsed in the Science Citation Index-Expanded (SCI-E) (1957–2015), Scopus (1976–2015), Medline/PubMed/GoPubMed® (1970–2015), ScIELO (1981–2014) and LILACS (1985- 2011). All types of articles were included and categorized by year of publication, number, type of scientific article, city and institution of origin, international cooperation, scientific journal, impact factor, language of publication, authors and H index. In SCI-E, 1,028 manuscripts were recovered, while Japan (21.9%) and the USA (17.7%) were the countries with highest scientific production. In this database, Asian region studies received 5,454 citations (H index=32). In Scopus 2161 items were recovered, corresponding to 45.8% of Asian countries. Japan (18.2%) was the first with the University of Miyazaki (11.7% of the country); South Korea (9.5%) was second with the Seoul National University (11.2% of the country). In SciELO 29 items were found, with no contributions from the Asian region. In LILACS 1487 articles were found (22.9% covering Asia). Among the databases, the *Journal of Parasitology* (Impact factor=1.227) showed the highest number of manuscripts and "Agatsuma T", from Japan, was the author with most records. Japan and South Korea lead global scientific production on paragonimiasis. By contrast, in Latin America, production has been extremely low especially in the last five years.

Keywords

paragonimiasis; trematode; bibliometric analysis; epidemiology; Asia

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Conflict of interest

The authors have no conflicts of interest to disclose.

INTRODUCTION

Approximately 292 million people are still at risk of paragonimiasis worldwide. This neglected foodborne parasitic zoonosis is mainly distributed in tropical and subtropical areas of Asia (Japan, South Korea, China, and Thailand), Africa (Cameroon) and Latin America (Ecuador) [1–5]. Currently, it is estimated that there are 23 million people infected in 48 countries, where the prevalence could be as high as 25% [6]. The complex life cycle of this trematode parasite, the wide distribution of species and the high intake of raw or undercooked shellfish have even turned paragonimiasis an important public health issue in Asia [7–9].

Paragonimiasis is caused by fluke infection of the species belonging to the genus *Paragonimus*. There are multiple species with a wide distribution and co-circulation, particularly in Asia. For instance, *P. westermani* is found in Southeast Asia, India, Japan, the Philippines and New Guinea [2, 3]. *P. miyasazakii* in Japan; *P. skrjabini* in China; *P. heterotremus* and *P. skrjabini* in Southeast Asia; *P. uterobilateralis* and *P. africanus* in West Africa; *P. kellicotti* in North America, and *P. mexicanus* in Central and South America.

The etiological agent could be transmitted by eating raw or undercooked shellfish, raw meat wrapper from carnivore's hosts with young staves, and even by contaminated utensils [10, 11]. Besides, it could be a clinical challenge for its clinical and radiological likeness with TB, and the high prevalence of the disease in endemic regions [6].

Nowadays, even today there are not enough studies about sensitivity and specificity of diagnostic tests, therapeutic solutions neither the impact of preventive measures [3, 12–14]. These components play a fundamental role in controlling such infectious disease, providing an insight into the epidemiologic situation of each country and therefore there is a need of increase research in this sense [15].

On the other hand, there are not previous bibliometric research regarding paragonimiasis in the world. Bibliometric research allows to assess the contributions to the scientific literature. It can help to conceive a picture about the research situation, as well as to understand response of countries to public health priorities. It helps to recognize the interest of a country in solving problems based on scientific evidence, and identify the need to allocate budget for research development [16]. In this study, a bibliometric evaluation of scientific contributions on paragonimiasis was done in order to assess the level of scientific production of Asia and worldwide on the subject.

MATERIALS AND METHODS

A bibliometric descriptive study of the global scientific production in paragonimiasis was conducted with a focus on Asia. Science Citation Index-Expanded (SCI-E) database supplied by Thomson Reuters (1957–2015), SCOPUS (1976–2015) database provided by Elsevier, Index Medicus/Medline/PubMed by GoPubMed® system (1970–2015), the ScIELO (1981–2014) and LILACS (1985–2011) network, the last two data bases in Spanish, were assessed.

The search strategy was prepared by identifying adequate Descriptors in Health Sciences [Descriptores en Ciencias de la Salud] (DeCS) and Medical Subject Headings (MeSH). Different words were observed with mild morphological variability in titles and keywords so the term “Paragonim*” was used in order to include all possible options. This search was performed between July 27th and July 31st, 2015.

Variables assessed were the years of publication, number and type of scientific articles, city and institution of origin, international cooperation, scientific journals, impact factor, language of publication, authors and H index. All types of studies were included (*e.g.*, articles, reviews, letters, notes, conference papers, editorials, book chapters, etc.).

Data were tabulated and processed in Excel 2013® for Windows 7®, quantitative variables were described by means and standard deviations, and qualitative variables were summarized as proportions.

RESULTS

Science Citation Index - Expanded (SCI-E)

In SCI-E 1,028 articles were recovered, 55% of which corresponded to countries of Asia. From the total, 77% were original articles and 16.2% were published in the last five years (33.4±11.3 articles on average per year).

Japan and USA had the highest scientific production in Paragonimiasis, they have produced 21.9% and 17.7% of total items respectively, followed by South Korea with 12.9%, China 12.5% and Thailand with 6%. Countries with the lowest scientific production were Belgium, Cambodia, Cuba, Egypt, Gabon, among others with 0.19% of the total in this database.

On the other hand, the authors with most publications in the Asian region were: “Agatsuma T” from Japan with 18.5% of articles of the country, “Kong” with 16.5% of South Korea, “Davis GM” with the 6.2% in China and “Maleewong W” with 33.8% in Thailand. Based on this database the Asian region received 5454 citations (444.6±140.5 average per year in the last five years) with an H index of 32 for the region (Figure 1).

The scientific journal with the highest number of worldwide contributions was “Journal of Parasitology” (9.8% of the total), with an editorial line of ecology, evolution, behavior and also parasitology.

It has an impact factor of 1.227. This was followed by, the *Journal of Parasitology Research* (4.8% of total), which has a scope in publications on parasitology and infectious disease and has an impact factor of 2.098.

Then, *American Journal of Tropical Medicine and Hygiene* (3.9% of the total) which develops topics of infectious diseases, parasitology, virology and other tropical medicine related areas (impact factor of 2.699); *Journal of Helminthology* (3.4% of total), which develops editorial policies of zoology and parasitology (impact factor of 1.421); the *Tropenmedizin und parasitologie* (2.2% of total), which publishes on topics of tropical medicine and parasitology, and lacks of a registered impact factor. Regarding language, the

93.1% of the articles were published in English, 2.1% in German, 1.5% in Chinese, 1.5% in French and 0.9% in Spanish.

Scopus

In Scopus 2,161 items were found of which 45.8% corresponded to articles from Asian countries. A total of 69% were original articles of which 213 were published in the last five years (14.2% of original papers) with a mean of 57.6±18.4 articles per year. Japan has produced 18.2% of the articles in this database, followed by South Korea with 9.5%, USA 9.3%, China 6.5% and Thailand with 4.1%. Countries with lower contributions were: Norway, Oman, Papua New Guinea, Zambia and Zimbabwe with 0.04% (Figure 2).

International cooperation of Japan, the country with the highest scientific production, was observed in the 33.5% of the publications (4.8% with Thailand). The author with most scientific contributions was “Agatsuma T” from Kochi Medical School, with 11.4% of the publications and an H index =20. The institution with the largest scientific production was the University of Miyazaki with 11.7% of scientific production in Japan.

In South Korea, the institution with the highest production was the Seoul National University (11.2% of the country); the Mayo Clinic in USA (3.9% of the country); in China, the Chinese Center for Disease Prevention and Control Disease (18.3% of the country) and in Thailand, Mahidol University (47.2% of the country). The most published author in each country were “Kong” (11.2%), with an H index of 22; “Weil GJ” (3.9%), with an H index of 33; “Zhou XN” (7, 7%), with an H index of 33; and “Maleewong W.” (28.1%) with an H index of 16.

The Asian region obtained 6497 citations and had an H index of 35 in the subject by the assessed timeframe. The countries with the highest H index were USA (H index =28), Japan (H index =22), South Korea (H index =20), China (H index =19) and Thailand (H index =15).

The journals with the highest number of contributions in the world were: *Chinese Journal of Parasitology* (5.3% of the total), which has an editorial line of different medical related areas and an impact factor of 2,327; *Korean Journal of Parasitology* (5.2% of the total), which is centered in publications on parasitology and infectious disease (impact factor of 1.151); the *Japanese Journal of Parasitology* (4.7% of total) which publishes in different areas of parasitology and microbiology, without a registered impact factor; the *Southeast Asian Journal of Tropical Medicine and Public Health* (4.2% of total), which has developed editorial policies of infectious diseases, public, environmental health and occupational health (impact factor of 0.546); the *Journal of Parasitology* (4.1% of total), it publishes on topics related with ecology, evolution, behavior and parasitology (impact factor of 1.227); the 68.4% of the total articles were published in English, 10.3% in Chinese, 7.6% in Japanese, 2.9% in French and Korean.

Index Medicus/Medline/PubMed

At this database 1736 items were recovered worldwide 43.2% of them belonged to the Asian region. The 11.3% of the total was published in the last five years. In the period of 1984–

1989 was captured the highest relative value of research interest (0.00013) and in the last five years (2011–2015) has been reached relatively less research interest (0.00006) (Figure 3). The countries with the highest number of publications were South Korea 14.2%, Japan 10.1%, China 9.4%, Thailand 4.2% and USA 3.7%.

The countries with the lowest scientific output were: Argentina, Netherlands, Saudi Arabia, Equatorial Guinea and Madagascar with 0.05% of the global production.

It was found that international cooperation for South Korea was only 0.4%; in this country the author with most contributions was “Kong Y” with 13.7% of Korean publications, according to the network map collaboration (Figure 4). In Japan, the author with the highest number of contributions was “Agatsuma T” with 20% of the assessed publications; in China, “Feng Z” contributed the 3.7% of the country; in Thailand, “Maleewong W” contributed the 27.4%, and in USA “Procop G” contributed with the 4.6%.

The scientific journals with the highest number of worldwide contributions were: *Chinese Journal of Parasitology* (6.7% of the total) which has an editorial line of medical miscellany and an impact factor of 2,327; the *Journal of Parasitology* (4.8% of total) dedicated to publications on parasitology and infectious disease, which has an impact factor of 1.227; *Southeast Asian Journal of Tropical Medicine and Public Health* (4.7% of total) which centers in infectious diseases, public environmental health and occupational health. It has an impact factor of 0.546.

The *Journal of Parasitology Research* (2.3% of total) publishes on topics of parasitology and infectious disease has an impact factor of 2.098. The *American Journal of Tropical Medicine and Hygiene* (2.2% of the total) which works on infectious diseases, parasitology, virology and miscellaneous areas. It has an impact factor of 2.699.

SciELO and LILACS

In SciELO 29 articles were found. Seven were published in the last five years, and none published in 2015 (mean of 0.83±1.1 articles per year).

The countries with most contributions were Brazil (37.9%), Peru (20.7%) and Colombia (13.8%). Regarding to scientific journals, *Mem. Inst. Oswaldo Cruz* contributed with 13.8% of the scientific production of the region and *Revista Biomedica* together with *Rev. Peru. Med. Exp. Salud Pública* contributed with 10.3%. The 27.6% of articles were published in English.

In the LILACS database 1487 articles were recovered. The Asian region contributed with 22.9% of publications.

DISCUSSION

This study found that Asia contributed with the highest percentage (55%) of the global scientific production in paragonimiasis, as well as curiously represents a significant portion (22.9%) in the journals of the Latin American and Caribbean Literature in Health Sciences database (LILACS). The fact that the most prevalent infective species of *Paragonimus*

circulates in Asia would explain this scenario. There would be a relationship between this endemic disease and the public health concern translated into the scientific production [2, 3, 5, 8, 12, 17–19]. Nevertheless, the control of such parasitic disease is not always correlated with scientific production, as has been reported in multiple previous bibliometric studies for other endemic diseases, especially in the most developing countries [20].

In China, there are still about 22 million people infected with prevalence similar to those reported in Vietnam [3, 5]. Despite advances in research about the disease, other epidemiologic issues such as the prevalence in some endemic areas of Asia and Latin America, and the influence of the environment on the disease are still unknown [1, 3, 21]. By contrast, some Asian countries have reduced their incidence rates to almost undetectable levels such as Republic of Korea, a high endemic area [22]. However, marginalized communities still have high rates of infection [3, 23]. On the other hand, the higher proportion of articles published in the last five years in SCI and Scopus could be attributable to the general increase in scientific production, particularly, in microbiology and infectious diseases [24, 25]. Moreover, the impact of a disease in the scientific production may reflect its influence as a potential public health threat [26]. Despite not being the country with the highest number of publications, United States of America had the higher H index (H index of 28) in Scopus. The quality of USA publications in microbiology and infectious diseases, in general, could be explained by the kind of articles published as well the experience of their institutions and researchers [25–28]. At ScIELO, the proportion of articles from Brazil (37.9%), Peru (20.7%) and Colombia (13.8%), are comparable with those found in other infectious diseases such as leishmaniasis, malaria, Chagas disease and cryptococcosis, as well to the relative importance of paragonimiasis for the scientific community in such countries [19, 20, 29, 30]. It calls the attention the lack of studies about the epidemiology of the disease in Latin America, particularly in those countries with the highest risk of infection [3].

The journals with the highest number of publication were the Asian journals. Among the different databases those were *Journal of Parasitology* (Q2, Q3; Scopus, SCI-E), *Chinese Journal of Parasitology* (Q3, Scopus), *Southeast Asian Journal of Tropical Medicine and Public Health* (Q3, Q4; Scopus, SCI-E), *Journal of Parasitology Research* (Q2, Scopus) and *American Journal of Tropical Medicine and Hygiene* (Q1; Scopus, SCI-E). Not with standing, not being a bilingual (Spanish/English) or English language publishing journal would reduce the visibility and impact of other publications, particularly like *Chinese Journal of Parasitology* publishing in Chinese. The international cooperation could increase the global reach of the journals positively by influencing the quality of research [31–34].

The lack of uniformity of some variables between databases limits the analysis and comparison of information. For example, the H index is only possible to determine through Scopus and SCI, but they are not equal as they do not cover the same journals. Another limitation is that the impact factor of the journals does not necessarily represent the quality of the articles, and this often criticized as a tool to measure the quality of scientific research. Although the H index and the impact factor are widely used to evaluate research quality, they have some limitations to be used in bibliometric research. However, although its

limitations, this study is the first bibliometric approach that analyze these databases for paragonimiasis.

In conclusion, Asian countries are those who lead the production on this topic; among them, particularly, Japan and South Korea. Meanwhile, production in this sector in Latin America has been scarce, especially in the last five years. This parasitic disease represents a public health issue for the sanitary authorities and clinical problem for the physicians in endemic areas. To get a comprehensive surveillance and control, the endemic dispersion, transmission cycle, molecular epidemiology, pathogenesis, and clinical features of paragonimiasis need to be studied better.

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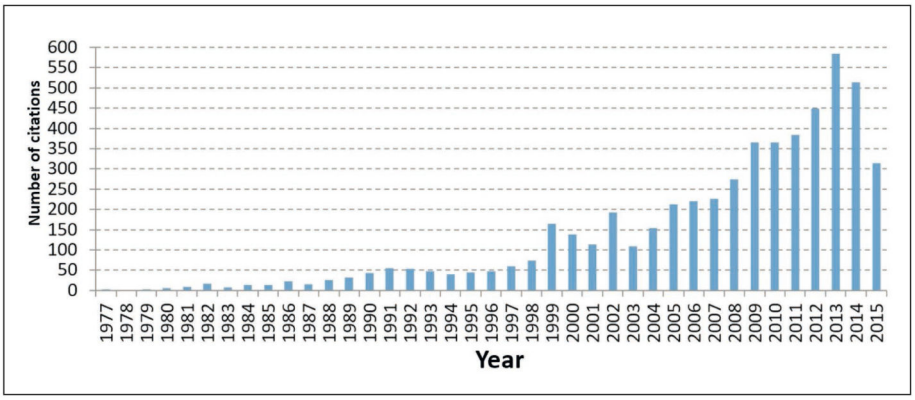

Figure 1.
Number of citations in the Asian region on paragonimiasis, from SCI-E.

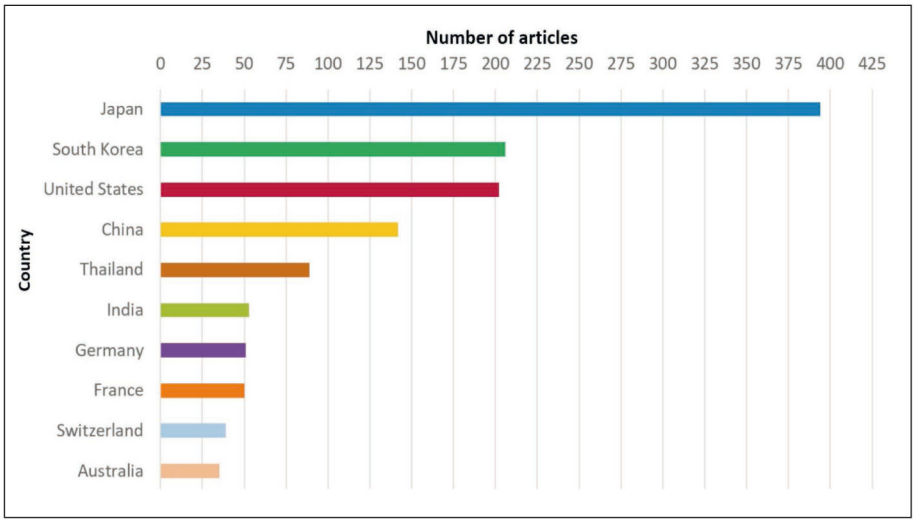

Figure 2.
Countries with the higher scientific production on paragonimiasis in the world, Scopus.

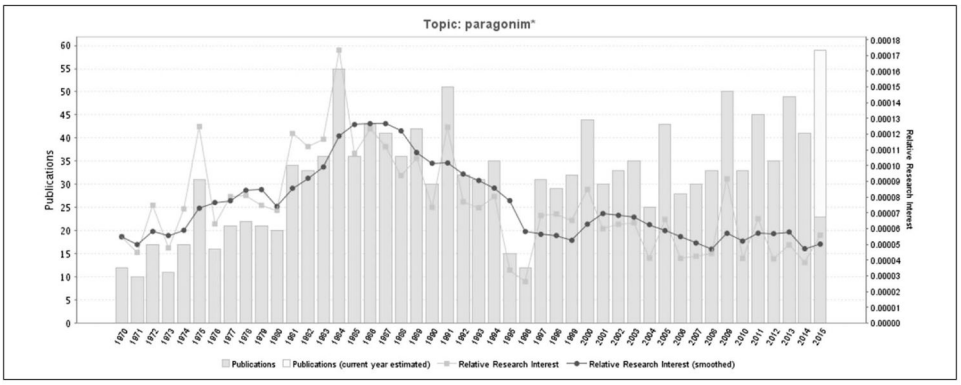

Figure 3.
Global scientific production (1970–2015) on paragonimiasis, Medline (by GoPubMed®).

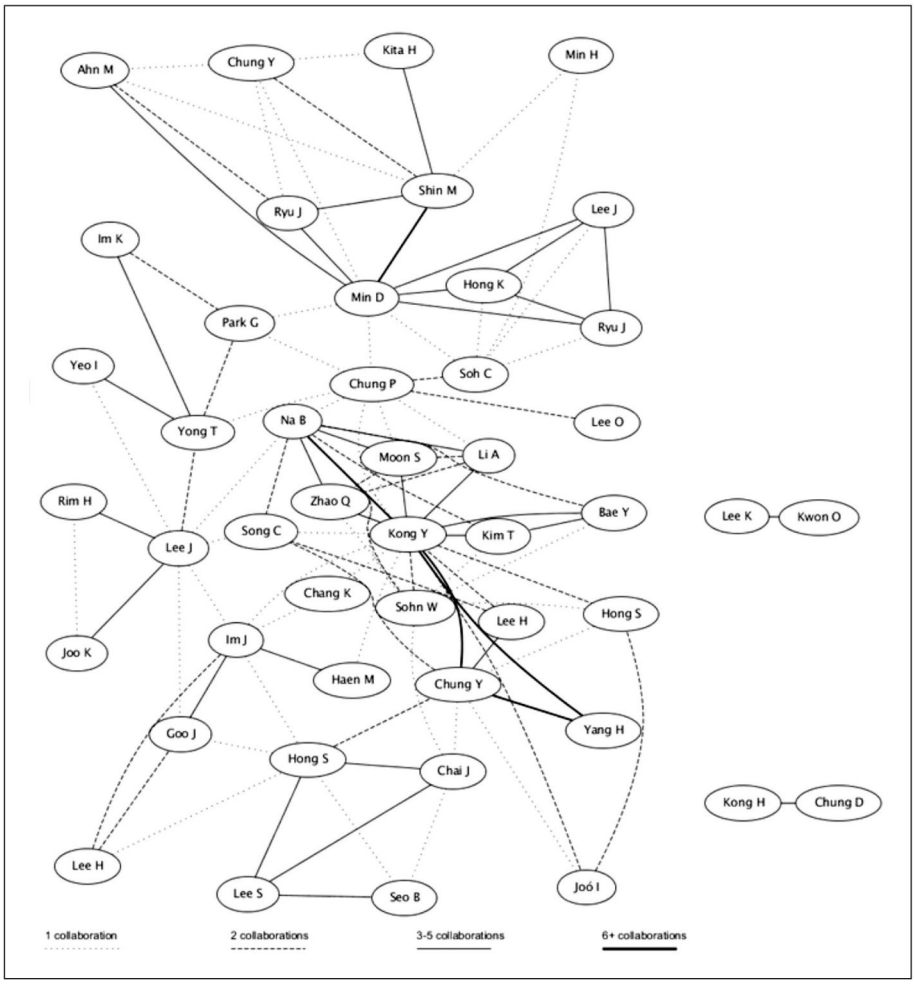

Figure 4.

Paragonimiasis cooperation networks in Japan, based on production registered Medline (by GoPubMed®).