
Mapping of Kala-Azar Research Publications: A Scientometric Analysis

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Abstract

The purpose of the study is to analyse the research productivity on 'Kala-Azar' during the period of 35 years, i.e., from 1st January 1989 to 31st December 2023, covered in the Web of Science database. A total of 2,973 publications were covered during the study period, which were processed using the BibExcel tool and VOSviewer to generate the results. The main objective of the study was to conduct a scientometric analysis of publications on Kala-Azar. Various scientometric parameters, such as Annual Growth Rate, Doubling Time, Degree of Collaboration, Research Areas, Most productive journals, Most productive authors, and Most productive countries, are analysed in the study.

Keywords

Scientometrics: Doubling Time: Kala-Azar: Annual Growth Rate: Authorship Pattern: Degree of Collaboration

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I. INTRODUCTION

Visceral Leishmaniasis is commonly called as Kala-Azar (KA) or Black Disease. It is a slowly progressing indigenous disease which is caused by a protozoan parasite of the genus *Leishmania*. It is one of the forms of vector-borne disease, leishmaniasis. The main objective of the study was to analyse the literature on Kala-Azar worldwide. According to the World Health Organisation, among vector-borne diseases, leishmaniasis is caused by protozoan parasites transmitted by infected female phlebotomine sandflies through biting (Organisation). The main infections of leishmaniasis are visceral leishmaniasis (VL), cutaneous leishmaniasis (CL) and mucocutaneous leishmaniasis (ML). It is most dangerous and the fatal rate is 95%, if untreated. The symptoms of the infections are weight loss, anaemia, enlargement of spleen and liver and irregular fever. Countries like Brazil, East Africa, and India are mostly affected by this disease. Every year 50,000 to 90,000 new cases are reported around the world.

In India, it is endemic in the eastern states like West Bengal, Uttar Pradesh, Bihar, Jharkhand, a few other states and 54 districts that cover 165.4 million people. It is prevalent in rural areas among poor socio-economic groups (Mission, 2024). It is estimated that the prevalent of 10-20% of reports in the Indian sub continent and 50-60% of cases in East Africa was affected by Post-Kala-Azar Dermal Leishmaniasis (PKDL) and it will eradicate the Kala-Azar by effective PKDL treatment (Kumar et al., 2023). It was found that the pentavalent antimonial compounds are the main primary agents to treat Kala-Azar which also includes amphotericin-B and pentamidine as secondary agents. It will be helpful for the development of drug liposomal amphotericin-B. The combination of stibogluconate with either paromomycin or interferon-gamma can cure patients with drug-resistant Kala-Azar (Aggarwal et al., 1999). An active PKDL patient with Kala-Azar are reported in Africa and very few cases are found in South Asia. The patients are diagnosed and treated with amphotericin-B and miltefosine for 12 weeks and they are recovered (Hasan et al., 2023).

Kala-Azar affected most of the Asian and African regions. A 10-month-old male infant, whose family with poor socio-economic background lived in a small village in Northern Pakistan suffered with fever from 100.8⁰F to 102⁰F, blood pressure of 90/165 m/mhg, heart rate of 130 bpm and respiratory rate of 24 breaths per minute was diagnosed by the disease Kala-Azar (Pasha et al., 2022).

II. REVIEW OF LITERATURE

A scientometric analysis was conducted on 'Canine Leishmaniasis' during 2000 to 2020 (Oliás-Molero et al.,

2021). A study on Nanoparticles for leishmaniasis treatment was conducted from 1991 to 2022 and a sample of 524 documents from scopus database were analysed (Mazón-Ortiz et al., 2023). The authors (Menezes et al., 2022) investigated a scientometric analysis on 'SARS-CoV-2' extracted from the PubMed database, which yielded 492 articles on October 2022 in Brazil during the pandemic. The authors (Al-Mutawakel et al., 2010) examined a scientometric analysis of the worldwide research output of leishmaniasis from 1957 to 2006, which results in the fact that Western countries like the USA, UK and Germany published more publications, and also countries like Brazil and India had a high number of research publications. The authors (Ram, 2018) investigated the India's contribution in leishmaniasis research which focuses the contribution and impact done by Indian global leishmaniasis research. The bibliographic data for the fifty years (1968-2017) was analysed and found that the Indian contributions are making a good global impact. The authors (Soosaraei et al., 2018) explored a bibliometric analysis on leishmaniasis indexed in Web of Science database during the period 2006 and 2015. The data were analysed using the softwares like Pajek and VOSviewer. It was found that 13,658 records were published, and countries like Brazil, the USA and India lead scientific research output on leishmaniasis publications. The authors (Ahmed, K K Mueen; Gupta, B M; Gupta, 2018) investigated a scientometric assessment of leishmaniasis research publications in India during the period 2008-2017. It was found that, 1970 Indian publications were done on the research and Scopus database was accessed for retrieving the data. The most productive country was Brazil with global share (22.95%) followed by USA (17.78%) and India (12.32%) respectively. The most productive organizations and authors were from Banaras Hindu University, Varanasi and Shyam Sundar with 78.38% and 57.06% respectively. A scientometric assessment on global leishmaniasis indexed by Science Citation Index-Expanded was analysed from 1997-2016. A sum of 14,779 records are filtered for the study. The highest publications came from Brazil, followed by USA and India. The most preferred journal is 'American Journal of Tropical Medicine and Hygiene, USA', and Shyam Sundar was the most prolific author (Dwivedi, 2018).

The author (Dwivedi, 2019) examined an Indo-US collaboration pattern of research output indexed in the Science Citation Index-Expanded for the years 2012-2016. The country Brazil was the most productive country with second lowest international collaboration. India and USA published 59% of records bilaterally among 68 papers. The authors (Patra, Swapan Kumar; Adhikary, 2023) examined a scientometric analysis on 'Neglected Tropical Diseases' in the Indian context from the Scopus database, which comprises 24,000 peer-reviewed journals from more

than 5,000 publishers globally. A total of 5,23,389 records were retrieved and found that USA as the most productive country with 1,15,624 (22.09%) publications and followed by United Kingdom 42,466 (8.11%) and Brazil 36,964 (7.06%) respectively. Also, India contributed 30,694 records (5.84%). A worldwide co-authorship pattern on leishmaniasis from 1945 to 2010 in the Medline database was done and found that 735 authors participated with 154 major research clusters. Brazil was the leading country followed by USA, India, France, Spain, UK and Italy (González-Alcaide et al., 2013). Another paper examines 21,362 publications and shows a gradual increase from 6,983 records between 2010 and 2014 to 14,379 publications from 2015 to March 2023. The USA was the leading country in citations, bibliographic coupling and co-authorship. Most productive authors and organisations are from European countries (Yona et al., n.d.). The authors (Huamani et al., 2014) investigated a bibliometric research using Scopus database during the period 2000 to 2011 and retrieved 3.174 records for the analysis. It was found that 2,272 publications are original articles, participating 1,160 different institutions, 58 different countries and 398 scientific journals. Brazil with 60.7% records and Oswaldo Cruz Foundation had 18% records were the leading country and organization.

The authors (Perez-Cabezas et al., 2019) examined a bibliometric analysis on 'Guillain-Barre Syndrome and Zika Infection' collected from Web of Science database during the period 2014 to 2018 which consists of 384 articles and reviews. It was also found that the highest publication of 186 articles in the year 2017 and mostly cited documents were published in the year 2016. The authors investigated a scientometric and visualization analysis on 'Nipah Virus' during the year 2018, which shows 1,007 records. Software like 'Gephi', 'Vosviewer' and 'Sciencescape' was used for creating the visualisation networks. The United States, with 469 records, was the leading published country, and North America, with 522 records, was the leading published continent all around the world (Singh, Nirmal et al., 2019). The authors (Koster et al., 2016) examined a scientometric analysis on 'Rotavirus' which leads to the dehydration and severe diarrheal disease among young and infant childrens all around the world retrieved from Web of Science database during the period 1900 to 2013 and found 5,907 documents for the analysis. A scientific research was conducted on 'Ebola Virus Disease or EVD' in West Africa during the period 1900 to 2013 using the Web of Science database. The first record of Ebola was published in 1977, with 2,477 publications (Yi et al., 2016).

III. SCOPE AND METHODOLOGY

The necessary data of information for the following study 'Kala-Azar' were downloaded by a search in the Web of

Science database by using the keyword “Kala-Azar” published by Clarivate Analytics. The database on the research keyword starts indexing from the year 1989, and at least 2,973 publications have been done till the year 2023. Hence, we focused on analysing all documents published from 1989 to 2023. To analyse bibliographic data from sources like Web of Science, a user-friendly, versatile tool for generating files is Bibexcel, which enables researchers to conduct citation analyses and identify current publication trends. So, a total of 2,973 documents were extracted as .txt file and imported in to Excel datasheet by using the Bibexcel software for the further analysis.

IV. OBJECTIVES OF THE STUDY

The objectives of the present study are to analyze the publication pattern of Kala-Azar during 1989 to 2023, retrieving data from indexed publications in Web of Science Database. The study had the following objectives:

- To find out the year-wise global publications on kala-azar and the annual growth rate during 1989 to 2023.
- To examine the distribution of publications by language and document.
- To analyse the authorship pattern and degree of collaboration of publications.
- To identify the most productive journals of publications on kala-azar.

- To identify the top-10 research areas of publication in the field of kala-azar.
- To find out the most productive authors in kala-azar literature publications.
- To know about the most productive country of publications on kala-azar.

V. ANALYSIS OF DATA AND INTERPRETATION

Table I below shows that, since 1989, publications have been consistent, resulting in fewer than 90 publications until 2006. During this period, the least output, with 13 publications, was in 1990, and more than 80 publications were identified four times in 1995, 1998, 1999, and 2005, but none reached 90 publications. The highest number of publications was in 2006, with 114. From 2006 to 2021, there were more than 100 publications on Kala Azar. The maximum publications appeared in the year 2010 with 141 articles (4.742 % share) and during the year 2022 and 2023, it resulted 77 and 71 publications respectively. The highest AGR was reached during the year 1991 with 238.48 followed by 82.22 in the year 1998 and a least of -43.47 AGR recorded in the year 1990.

The Annual Growth Rate was derived by using the formula given by (Kumar and Kaliyaperumal (2015) which is shown below:

$$AGR = \frac{\text{End Value} - \text{First Value}}{\text{First Value}} \times 100$$

TABLE I: YEAR-WISE PUBLICATION AND ANNUAL GROWTH RATE

Year	No. of Publications	Percentage	AGR	Year	No. of Publications	Percentage	AGR
1989	23	0.773	0	2007	109	3.666	-4.38
1990	13	0.437	-43.47	2008	113	3.801	3.67
1991	44	1.480	238.46	2009	121	4.070	7.08
1992	54	1.816	22.73	2010	141	4.742	16.53
1993	54	1.816	0	2011	124	4.171	12.06
1994	54	1.816	0	2012	117	3.935	-5.64
1995	89	2.993	64.81	2013	127	4.272	8.55
1996	52	1.749	-41.57	2014	126	4.238	-0.79
1997	45	1.513	-13.46	2015	108	3.632	-14.28
1998	82	2.758	82.22	2016	110	3.700	1.85
1999	84	2.825	2.43	2017	106	3.565	-3.64
2000	58	1.951	-30.95	2018	102	3.431	-3.77
2001	62	2.085	6.90	2019	82	2.758	-19.61
2002	65	2.186	4.84	2020	115	3.868	40.24
2003	67	2.253	3.08	2021	116	3.902	0.87
2004	65	2.186	-2.98	2022	77	2.590	-33.62
2005	83	2.791	27.69	2023	71	2388	-7.79
2006	114	3.834	37.35				

TABLE II: DOCUMENT-WISE DISTRIBUTION

Document Type	No. of Records	Percentage
Article	2,249	75.65
Review	341	11.47
Letter	122	4.10
Meeting Abstract	84	2.82
Editorial Material	58	1.95
Note	45	1.51
Proceedings Paper	45	1.51
Correction	09	0.30
Article; Early Access	05	0.17
News Item	04	0.13
Retraction	02	0.07
Review; Book Chapter	02	0.07
Review; Early Access	02	0.07
Correction, Addition	01	0.03
Book Review	01	0.03
Article; Retracted Publication	01	0.03
Reprint	01	0.03
Discussion	01	0.03
Total	2,973	100

The first basic search with the keyword ‘Kala Azar’ indexed in Web of Science databases was done and retrieved a total of 2,973 documents published during the period 1989 to 2023. We detected that the prominent type of document published was ‘Articles’ with 2,249 publications (75.65% share) followed by ‘Reviews’ with 341 documents (11.47% share). Other most produced document items were letter, meeting abstract, editorial material, note and proceeding paper (4.10%, 2.82%, 1.95% and 1.51%) respectively. Also few other publications like book review, book chapter, news items etc., included in the publications (Table II).

TABLE III: LANGUAGE-WISE DISTRIBUTION

Languages	No. of Records	Cumulative No. of Records	Percentage
English	2,883	2,883	96.97
French	38	2,921	1.28
German	21	2,942	0.71
Spanish	19	2,961	0.64
Portuguese	10	2,971	0.34
Turkish	02	2,973	0.07
Total	2,973	2,973	100

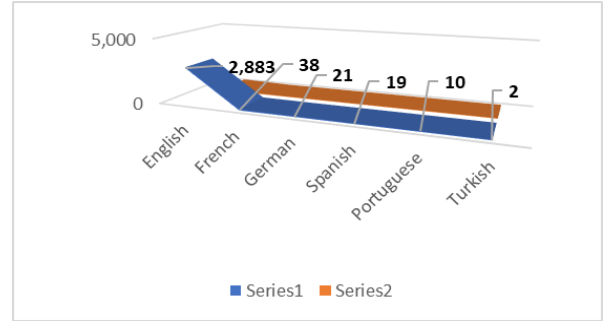


Figure 1: Language-wise Distribution

Among 2,973 documents published on Kala Azar during the period 1989 to 2023, it was observed that most of the documents were published in the English language, with 2,883 publications (96.97% share), which dominates all other languages globally. Also, other languages like French, German, Spanish, Portuguese and Turkish include (1.28%, 0.71%, 0.64%, 0.34% and 0.07%) respectively (Table III and Figure 1).

TABLE IV: AUTHORSHIP PATTERN

No. of Authors	No. of Records	Percentage
1 Author	164	5.52
2 Authors	227	7.63
3 Authors	350	11.77
4 Authors	346	11.64
5 Authors	367	12.34
6 Authors	392	13.18
7 Authors	295	9.92
8 Authors	213	7.16
9 Authors	186	6.26
10 Authors and Above	433	14.56
Total	2,973	100

It was found that the ten authors and above contributions on Kala Azar stand highest than others with 433 publications (14.56% share), followed by six authors with 392 publications (13.18% share), and five authors with 367 publications (12.34% share), respectively. Also, it was observed that the least number of contributions was made by single authors with 164 publications (5.52% share) compared with multiple author publications (Table IV).

TABLE V: DEGREE OF COLLABORATION

No. of Authors	No. of Records	Percentage
Single Author	164	5.52
Multiple Authors	2,809	94.48
Total	2,973	100

The study on Kala Azar involved 79 different research areas in the field. The top 10 research areas were identified on the basis of number of publications. The most dominant research category was “Tropical Medicine” (950 publications) ranked first with 17.80% share followed by “Parasitology” in the second position with 12.94% share (691 publications) and “Public, Environmental and Occupational Health” ranks in the third position (638

publications) with 11.95 % share respectively. The other focused research areas are Infectious Diseases, Immunology, Microbiology, General and Internal Medicine, Pharmacology and Pharmacy, Research and Experimental Medicine and Dermatology globally (Table VII).

TABLE VIII MOST PRODUCTIVE AUTHORS

Author	Institutions	Country	Record Count	Percentage
Sundar, Shyam	Banaras Hindu University, Varanasi	India	278	9.35
Boelaert, Marleen	Institute of Tropical Medicine	Belgium	130	4.37
Das, Pradeep	Rajendra Memorial Research Institute of Medical Sciences, Bihar	India	127	4.27
Rijal, Suman	Drugs for Neglected Diseases, New Delhi	India	86	2.89
Salotra, Poonam	National Institute of Pathology, New Delhi	India	82	2.76
Mondal, Dinesh	International Centre for Diarrhoeal Disease Research, Dhaka	Bangladesh	80	2.69
Pandey, Krishna	Rajendra Memorial Research Institute of Medical Sciences, Bihar	India	76	2.56
Thakur, C P	Patna Medical College, Bihar	India	63	2.12
Ramesh, V	VMMC and Safdarjung Hospital, New Delhi	India	62	2.08
Kumar, V	Rajendra Memorial Research Institute of Medical Sciences, Bihar	India	60	2.02

A total of 8,655 authors participated in the study and contributed a total number of 2,973 papers on Kala Azar literature. Among them, 164 were single-authored document authors and 2,809 were multi-authored documents. Among the top 10 productive authors, eight authors are from India and each one from Belgium and Bangladesh. The most productive author was Sundar, Shyam from Banaras Hindu University, Varanasi who contributed to 278 publications, which was 9.35 % of all publications. Boelaert, Marleen from Institute of Tropical Medicine, Belgium was next with 130 publications, accounting for 4.37 %. They were followed by Das, Pradeep (n=127, 4.27%, Rajendra Memorial Research Institute of Medical Sciences, Bihar), Rijal, Suman (n= 86, 2.89%, Drugs for Neglected Diseases, New Delhi) and Salotra, Poonam (n=82, 2.76%, National Institute of Pathology, New Delhi) from India (Table VIII and Figure 3).

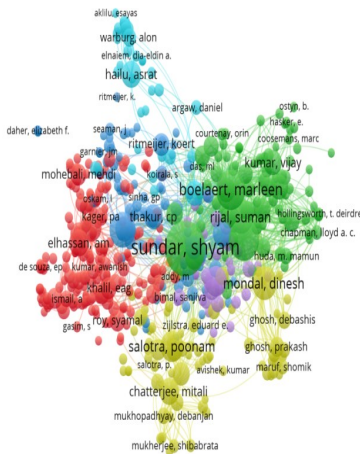


Figure 3: Most Productive Authors Network

TABLE IX: MOST PRODUCTIVE COUNTRIES

Country	Total Publications	Percentage	Rank	TC	ACPP	TLS
India	1,064	35.79	1	35,799	33.64	709

USA	441	14.83	2	29,980	67.98	593
Brazil	326	10.96	3	10,488	32.17	186
England	299	10.06	4	16,821	56.26	602
Switzerland	205	6.89	5	14,224	69.38	571
Belgium	194	6.52	6	9,247	47.66	455
Sudan	170	5.72	7	7,471	43.95	285
Spain	159	5.35	8	9,791	61.58	181
Netherlands	158	5.31	9	7,523	47.61	280
Bangladesh	149	5.01	10	2,807	18.83	279

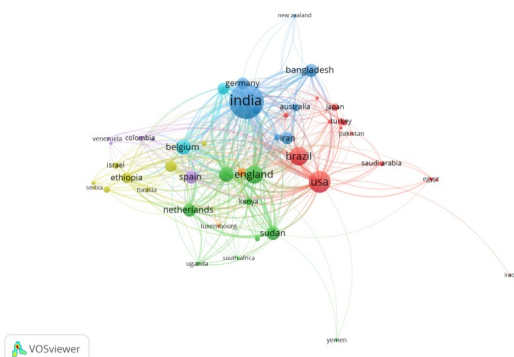


Figure 4 Most Productive Countries Network

A total of 2,973 documents were contributed by 107 countries to this field of research. Among them, developing countries account for the majority, and there are also some developed countries. Most studies on Kala Azar were published in India, the most productive country in this study (n = 1,064, accounting for 35.79% of all). USA came after India (n = 441, 14.83%). They were followed by Brazil (n = 326, 10.96%), England (n = 299, 10.06%), Switzerland (n = 205, 6.89%), Belgium (n = 194, 6.52%), Sudan (n = 170, 5.72%), Spain (n = 159, 5.35%), Netherlands (n = 158, 5.31%), and Bangladesh (n = 149, 5.01%).

Table IX lists the top 10 most cited countries. The documents published in India had the most citations (n = 35,799), followed by the USA (n = 29,980), England (n = 16,821), Switzerland (n = 14,224), and Brazil (n = 10,488). The co-authorship analysis shows that, the top 3 countries in order of total link strength, India came in the first place (TLS = 709), followed by England (TLS = 602), and the USA (TLS = 593) respectively (**Table IX and Figure 4**).

VI. DISCUSSION

The purpose of this study is to identify publication trends for one vector-borne disease, Kala-Azar. This study covers 35 years of publications indexed in the Web of Science Database. A scientometric analysis was carried out by

using bibexcel and vosviewer softwares to find various parameters like research productivity, annual growth rate, productive journals and countries etc., since 1989 to 2023. It was identified that in the early 1989, the publication trend was merely 23 counts, which continues below 100 numbers till 2005. But, from the year 2006, it climbed to 114 publications which maintain a stable research growth with more than 100 publications till the year 2018. It was also found that India’s contribution in this field was dominant among the rest of the world, which includes one of the asian country, Bangladesh. Most of the literature published authors were from India, which shows that eight authors from India, one from Bangladesh and another from Belgium are among the top ten authors' contributions in Kala-Azar.

The Indian journals published comparatively less literature than those all over the world. ‘Indian Journal of Medical Research’ in the seventh position and also the ‘Journal of Vector Borne Disease’ stand in 20th position with 22 publications. Further, some of the research areas like topical medicine, parasitology, public, environmental, occupational health, infectious diseases, immunology, microbiology, pharmacy medicine and dermatology exposed the research gaps among each other which directs the research community to move forward in the field of Kala-Azar in future.

VII. CONCLUSION

To conduct the study, it was understood that collaborations among authors from the Asian continents were greater than those from other continents. Also, it was found that the sources of publication journals are international. So the researchers in the field of medicine or clinical practitioners in vector-borne diseases should explore future research trends and collaborations in Kala-Azar research. Also, this scientometric study on kala-azar research will discover the current pattern of publications for the past 35 years in case of research productivity, productive authors and international collaborations.

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