

Leishmaniasis Research in India: A Scientometric Assessment of Publications during 2008-17

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ABSTRACT

The paper examines 1970 Indian publications on Leishmaniasis research, as covered in Scopus database during 2008-17, registering an annual average growth rate of 17.68%, global publication share of 12.32%, international collaborative publication share of 26.85% and qualitative citation impact averaged to 17.28 citations per paper. The top 10 most productive countries individually contributed global share from 4.13% to 22.95% with largest global publication share coming from Brazil (22.95%), followed by USA (17.78%), India (12.32%), U.K., Iran and Spain (from 7.21% to 8.20%), France, Germany, Italy and Switzerland (from 4.13% to 5.95%) during 2008-17. Together, the 10 most productive countries accounted for 95.57% share of global publication output during 2008-17. Seven of the top 10 countries scored relative citation index above the world average of 1.32: Switzerland (2.17), Italy (2.0), U.K. (1.93), France (1.86), USA (1.80), Spain (1.58) and Germany (1.43) during 2008-17. Medicine, among subjects, accounted for the highest publications share (55.43%), followed by biochemistry, genetics and molecular biology (32.94%), immunology and microbiology (31.68%), pharmacology, toxicology and pharmaceuticals (20.81%), chemistry (7.77%) and agricultural and biological sciences (7.56%) during 2008-17. The top 15 most productive Indian organizations and authors together contributed 78.38% and 57.06% respectively as their share of Indian publication output and 95.86% and 52.23% respectively as their share of Indian citation output during 2008-17. Among the total journal output of 1603 papers, the top 15 journals contributed 26.17% share to the Indian journal output during 2008-17. 20 papers registered from 102 to 5725 citations per paper, which together received 211897 citations, leading to an average of 594.85 citations per paper during 2008-17.

Key words: Leishmaniasis research, Indian publications, Scientometrics, Bibliometrics.

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INTRODUCTION

Leishmaniasis is a group of diseases and is caused by protozoan parasites from over 20 genus Leishmania species and is transmitted to humans by the bite of infected tiny (2 to 3 mm long) female insect vector phlebotomine sandfly, which breed in forest areas, caves, or the burrows of small rodents. Of the 500 known phlebotomine species, only 30 have been found to transmit leishmaniasis. The epidemiology of leishmaniasis depends on the characteristics of the parasite species, the local ecological characteristics of the transmission sites, current and past exposure of the human population to the parasite, and human behavior. Some 70 animal species, including humans, have been found as natural reservoir hosts of Leishmania parasites.^{1,2}

Human infection can be caused by several species of Leishmania, which are included in four complexes: tropica (*L. tropica*, *L. major*, *L. minor*, and *L. aethiopica*), mexicana (*L. mexicana*, *L. amazonensis*, *L. pifanoi*, and *L. venezuelensis*), braziliensis or vianina (*L. braziliensis*, *L. guyanensis*, *L. panamensis*, and

L. peruviana), and donovani (*L. donovani*, *L. infantum*, *L. chagasi*, *L. sinensis*, and *L. nilotica*).

Only a small fraction of those infected by Leishmania parasites will eventually develop the disease. The disease affects some of the poorest people on earth and is associated with malnutrition, population displacement, poor housing, a weak immune system and lack of financial resources. Leishmaniasis is linked to environmental changes such as deforestation, building of dams, irrigation schemes and urbanization. Leishmaniasis threatens about 350 million men, women and children in 88 countries around the world. As many as 12 million people are believed to be currently infected, with about 1 to 2 million estimated new cases occurring every year.¹⁻¹

The disease can have a wide range of clinical symptoms, which may be cutaneous, mucocutaneous or visceral. Cutaneous leishmaniasis is the most common form. Visceral leishmaniasis (VL), also known as kala-azar is the most severe form, in which vital organs of the body are affected. It is fatal if left

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untreated in over 95% of cases. It is characterized by prolonged high fever, substantial weight loss, swelling of the spleen and liver, and anemia. Most cases occur in Brazil, East Africa and in South-East Asia. An estimated 50,000 to 90,000 new cases of VL occur worldwide each year. In 2015, more than 90% of new cases reported to WHO occurred in 7 countries: Brazil, Ethiopia, India, Kenya, Somalia, South Sudan and Sudan. Of the estimated 500,000 people in the world infected each year, nearly 100,000 are estimated to occur in South East Asia Region. Three most affected countries in South East Asia Region are Bangladesh, India and Nepal. The disease is now being reported in 45 districts in Bangladesh, 52 in India and 12 in Nepal.^{1,2} Of the 54 endemic districts across the four states in India, Bihar state alone reports more than 70% of the total reported cases with approximately 35 million people at risk of contracting the disease. According to the National Vector Borne Disease Control Programme (NVBDCP, Central nodal agency of India) in 2016, VL cases have declined by 32% and 10% respectively in comparison with the year 2014.^{1,3}

Cutaneous leishmaniasis (CL) is the most common form of leishmaniasis and causes skin lesions, mainly ulcers, on exposed parts of the body, leaving life-long scars and serious disability. It is estimated that between 600,000 to 1 million new cases occur worldwide annually. About 95% of CL cases occur in the Americas, the Mediterranean basin, the Middle East and Central Asia. In 2015 over two thirds of new CL cases occurred in 6 countries: Afghanistan, Algeria, Brazil, Colombia, Iran (Islamic Republic of) and the Syrian Arab Republic. It is estimated that between 600,000 to 1 million new cases occur worldwide annually. Mucocutaneous leishmaniasis leads to partial or total destruction of mucous membranes of the nose, mouth and throat. Over 90% of mucocutaneous leishmaniasis cases occur in Bolivia (the Plurinational State of), Brazil, Ethiopia and Peru.^{1,2}

Literature Review

Only a few international and regional bibliometric studies have been published in this field. Among the various international studies, González-Alcaide, Huamani, Jinseo and Ramos⁴ presented a bibliometric review of leishmaniasis research output (20,780 papers in 1846 journals) indexed in PubMed during a 66-year period. USA was the predominant country with 16.8% share, followed by Brazil (14.9%) and India (9.0%). The production ranking changed when the number of publications was normalized by population (Israel and Switzerland), by gross domestic product (Nepal and Tunisia), and by gross national income per capita (India and Ethiopia). For geographical area distribution, Europe took the lead with 31.7% share, followed by Latin America (24.5%), etc. Gonzalez-Alcaide, Huamani, Park and Ramos⁵ studied leishmaniasis publications in the Medline database from 1945 to 2010, analyzing them according to bibliometric indicators and statistics from social network analysis. Examining aspects such as scientific production, diachronic evolution, and collaboration and configuration of the research groups in the field, the authors have considered the different types of *Leishmania* studied and the institutional affiliation and nationality of the authors. Soosaraeia, Akbar Khassheh, Fakharci and Hezarjaribic⁶ examined global publications on leishmaniasis during 2006-15. Brazil, USA, and India lead scientific production on leishmaniasis research. The United States, United Kingdom and Australia had the most collaborative share in performing the studies of leishmaniasis with each other. The study also identified leading organizations and authors. Among regional studies, Perilla-Gonzalez, Gomez-Suta, Delgado-Osorio, Hurtado-Hurtado, Baquero-Rodriguez, Lopez-Isaza, Lagos-Grisales, Villegas, Soraya and Rodriguez-Morales⁷ presented a bibliometric assessment of the Latin American scientific production (2857 articles) in leishmaniasis till 2013. Different study types, characterized by years, city/country of origin, journals and

more productive authors, by country, cite and H index were examined. Since there was no comprehensive bibliometric study on Indian output, as a result we decided to undertake the present study.

OBJECTIVES

The main objectives of the present study are to study the performance of Indian Leishmaniasis research during 2008-17, deriving publications data from indexed publications in Scopus international database. The study had the following objectives: (i) To study the global research output and output of top 10 most productive countries including its output, global share, citation impact and share of international collaborative publications; (ii) To study the growth of Indian Leishmaniasis research output, its global share and its citation impact; (iii) To study the India's share of international collaboration publications and significant contribution of foreign partner countries; (iv) To study the Indian research output by broad subject areas and the dynamics of its growth and decline; (v) To study the distribution of Indian research output by type of Leishmaniasis research; (vi) To study the publication productivity and citation impact of top 15 Indian most productive organizations and authors; (vii) To study the modes of communication by Indian scholars and (viii) To study the bibliographic characteristics of high cited papers.

METHODOLOGY

The Leishmaniasis research publications landscape from 2008 through 2017 was identified and studied using the Scopus database (<http://www.scopus.com>). A keyword search was used to identify publications that contained the terms "Leishmania" or "Leishmaniasis" or "Cutaneous Leishmaniasis" or "Mucocutaneous Leishmaniasis" or "Visceral Leishmaniasis" in the "Article title tag" or "keyword tags" and restricting it to the period 2008-17 in "date range tag" was used for searching the global publication data (resulted into 15995 global publications) and this became the main search string. The main search string was later restricted to individual country name in "country tag" of 10 most productive countries (including India) one by one for obtaining publication data on individual top 10 most productive countries. The Indian search string had resulted into 1970 Indian publications on Leishmaniasis research during 2008-17. The Indian search string is further refined using provisions in Scopus database by "subject area tag", "country tag", "source title tag", "journal title name" and "affiliation tag", to get information on distribution of publications by subject, collaborating countries, author-wise, organization-wise and journal-wise. Separate search strategies were also developed to get information on different type of Leishmaniasis research. For citation data, citations to publications were also collected from date of publication till 16 April 2018.

(KEY("Leishmania" or "Leishmaniasis" or "Cutaneous Leishmaniasis" or "Mucocutaneous Leishmaniasis" or "Visceral Leishmaniasis") or TITLE ("Leishmania" or "Leishmaniasis" or "Cutaneous Leishmaniasis" or "Mucocutaneous Leishmaniasis" or "Visceral Leishmaniasis")) AND PUBYEAR > 2007 AND PUBYEAR < 2018

ANALYSIS

The global and Indian research output in Leishmaniasis research cumulated to 15995 and 1970 publications in 10 years during 2008-17, using a Scopus database. The annual output of world and India in Leishmaniasis research increased from 1355 to 1780 and from 145 to 211 publications from the year 2008 to the year 2017, registering 3.20% and 4.91% growth per annum. The cumulative global and Indian output in Leishmaniasis research computing in 5 years increased from 7664 and 905 during 2008-12 to 8331 and 1065 during 2013-17, registering growth rate of 8.70% and 17.68%, respectively. India's global publication share in Leishmani-

asis research was 12.32% during 2008-17, which increased from 11.81% to 12.78% from 2008-12 to 2013-17. Of the total Indian publications output, 81.37% (1603) was published as articles, 11.07% (218) as reviews, 2.94% (58) as letters, 1.07% (21) as editorials, 0.96% (19) as notes, 0.81% (16) each as short surveys and conference papers, 0.71% (14) as book chapters and 0.25 (5) as erratum. The citation impact of Indian publications on Leishmaniasis research averaged to 17.28 citations per publication (CPP) during 2008-17; five-yearly impact averaged to 27.07 CPP for the period 2008-12 which declined to 8.96 CPP in the succeeding five-year 2013-17 (Table 1).

International Collaboration

India's share of internationally collaborative papers (ICP) in Leishmaniasis research was 26.85% during 2008-17, which increased from 26.54% to 27.18% from 2008-12 to 2013-17. Among the leading countries contributing to internationally collaborative papers of India, USA topped the list with 38.75% share, followed by U.K. (19.85%), Belgium (19.47%),

Switzerland (18.15%), Nepal (12.67%), Australia and Bangladesh (7.56% each), Canada and Spain (6.05% each) during 2008-17. India's international collaborative publications share increased by 5.23% each in Canada and Spain, 4.70% in Germany and 0.46% in Australia, as against decrease by 10.77% in U.K., 8.24% in Nepal, 7.11% in Switzerland, 6.59% in USA, 3.88% in Belgium and 1.82% in Bangladesh from 2008-12 to 2013-17 (Table 2).

Top 10 Most Productive Countries in Global Leishmaniasis Research

The global research output in Leishmaniasis research had originated from as many as 158 countries in the world during 2008-17, of which 65 countries contributed 1-10 papers each, 57 countries 11-100 papers each, 25 countries 101-500 papers each, 5 countries 501-1000 papers, 4 countries 1001-2000 papers each and 2 countries 2001-3671 papers each. Top 10 most productive countries in Leishmaniasis research had contributed 661 to 3671 publications each during 2008-1917 (Table 3). Top 10 most

Table 1: Global and India Research Output in Leishmaniasis Research during 2008-17

Period	World							India	
	TP	TC	CPP	TP	TC	CPP	%TP	ICP	%ICP
2008	1355	35302	26.05	145	3087	21.29	10.70	34	23.45
2009	1481	39402	26.60	150	3187	21.25	10.13	24	16.00
2010	1517	33865	22.32	175	5130	29.31	11.54	55	31.43
2011	1594	32929	20.66	219	4593	20.97	13.74	75	34.25
2012	1717	33359	19.43	216	8501	39.36	12.58	58	26.85
2013	1718	21095	12.28	206	2525	12.26	11.99	55	26.70
2014	1857	16813	9.05	239	2331	9.75	12.87	75	31.38
2015	1718	12699	7.39	215	3658	17.01	12.51	51	23.72
2016	1758	6322	3.60	194	759	3.91	11.04	46	23.71
2017	1780	1940	1.09	211	265	1.26	11.85	56	26.54
2008-12	7664	174857	22.82	905	24498	27.07	11.81	246	27.18
2013-17	8331	58869	7.07	1065	9538	8.96	12.78	283	26.57
2008-17	15995	233726	14.61	1970	34036	17.28	12.32	529	26.85

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; ICP=International Collaborative Papers

Table 2: Publication Share of Leading Foreign Countries in India's Collaborative Papers (ICP) Research Output in Leishmaniasis Research during 2008-17.

S.No	Collaborative Country	Number of ICP			Share of ICP		
		2008-12	2013-17	2008-17	2008-12	2013-17	2008-17
1	USA	104	101	205	42.28	35.69	38.75
2	U.K.	63	42	105	25.61	14.84	19.85
3	Belgium	53	50	103	21.54	17.67	19.47
4	Switzerland	54	42	96	21.95	14.84	18.15
5	Nepal	42	25	67	17.07	8.83	12.67
6	Germany	18	34	52	7.32	12.01	9.83
7	Australia	18	22	40	7.32	7.77	7.56
8	Bangladesh	21	19	40	8.54	6.71	7.56
9	Canada	8	24	32	3.25	8.48	6.05
10	Spain	8	24	32	3.25	8.48	6.05
	Indian Total	246	283	529			

ICP=International Collaborative Papers

Table 3: Publication Output and Share (%) of Top 10 Most Productive Countries in India's Leishmaniasis Research during 2008-17.

S.No	Name of the Country	Number of Papers			Share of Papers			TC	CPP	ICP	%ICP	HCP	%HCP	RCI
		2008-12	2013-17	2008-17	2008-12	2013-17	2008-17							
1	Brazil	1546	2125	3671	20.17	25.51	22.95	41855	11.40	942	25.66	18	0.49	0.78
2	USA	1425	1419	2844	18.59	17.03	17.78	74707	26.27	1602	56.33	93	3.27	1.80
3	India	905	1065	1970	11.81	12.78	12.32	34036	17.28	529	26.85	20	1.02	1.18
4	U.K.	687	624	1311	8.96	7.49	8.20	36958	28.19	830	63.31	45	3.43	1.93
5	Iran	465	742	1207	6.07	8.91	7.55	11827	9.80	145	12.01	2	0.17	0.67
6	Spain	500	653	1153	6.52	7.84	7.21	26556	23.03	565	49.00	20	1.73	1.58
7	France	475	476	951	6.20	5.71	5.95	25908	27.24	611	64.25	21	2.21	1.86
8	Germany	415	427	842	5.41	5.13	5.26	17617	20.92	555	65.91	16	1.90	1.43
9	Italy	322	355	677	4.20	4.26	4.23	19759	29.19	337	49.78	20	2.95	2.00
10	Switzerland	331	330	661	4.32	3.96	4.13	20980	31.74	574	86.84	20	3.03	2.17
	Total	7071	8216	15287	92.26	98.62	95.57	310203	20.29	6690		275	1.80	1.39
	World Total	7664	8331	15995				233726	14.61					
	Top 10 Countries share in World Total													

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; ICP=International Collaborative Papers; HCP=High Cited Papers

productive countries in Leishmaniasis research accounted for 95.57% global publication share during 2008-17, which increased from 92.26% to 98.62% from 2008-12 to 2013-17. Each of top 10 countries accounted for 4.13% to 22.95% global publication share during 2008-17, with Brazil accounting for the highest publication share (22.95%), followed by USA (17.78%), India (12.32%), U.K., Iran and Spain (from 7.21% to 8.20%), France. Germany, Italy and Switzerland (from 4.13% to 5.95%) during 2008-17. The global publication share in five years increased by 5.33% in Brazil, 2.84% in Iran, 1.31% in Spain, 0.98% in India and 0.06% in Italy, as against decrease by 1.56% in USA, 1.47% in U.K., 0.48% in Spain, 0.36% in Switzerland and 0.29% in Germany from 2008-12 to 2013-17. Seven of the top 10 countries scored relative citation index above the world average of 1.32: Switzerland (2.17), Italy (2.0), U.K. (1.93), France (1.86), USA (1.80), Spain (1.58) and Germany (1.43) during 2008-17. Seven countries have achieved share of high cited papers above the average (1.65) of top 10 countries: U.K. (3.43), USA (3.27), Switzerland (3.03), Italy (2.95), France (2.21), Germany (1.90) and Spain (1.73) during 2008-17.

Subject-Wise Distribution of Research Output

The Indian Leishmaniasis research output published during 2008-17 is distributed over six sub-fields as identified in Scopus database classification, with medicine accounting for the highest publications share (55.43%), followed by biochemistry, genetics and molecular biology (32.94%), immunology and microbiology (31.68%), pharmacology, toxicology and pharmaceuticals (20.81%), chemistry (7.77%) and agricultural and biological sciences (7.56%) during 2008-17. The activity index, which computes change in research activity in a discipline over time 2008-12 to 2013-17 (world average activity index of a given subject is taken as 100), witnessed increase in only chemistry (from 85.36 to 112.44), as against decline of research activity in medicine (from 101.46 to 98.76), biochemistry, genetics and molecular biology (from 100.62 to 99.47), immunology and microbiology (from 108.14 to 93.08), pharmacology, toxicology and pharmaceuticals (from 102.47 to 97.90) and agricultural and biological sciences (from 111.03 to 90.63) from 2008-12 to 2013-17. Chemistry, among six subjects registered the highest citation impact per

paper (23.06), followed by medicine (20.53), pharmacology, toxicology and pharmaceuticals (16.68), biochemistry, genetics and molecular biology (14.63), immunology and microbiology (13.37) and agricultural and biological sciences (12.58) during 2008-17 (Table 4).

Types of Leishmaniasis Research

On classifying Indian Leishmaniasis research output by type of Leishmaniasis, it was observed that Visceral Leishmaniasis accounted for the largest publication share (54.62%), followed by Cutaneous Leishmaniasis (3.20) and Mucocutaneous Leishmaniasis (0.25%) during 2008-17. In terms of global publication share, again Visceral Leishmaniasis registered the highest share (21.86%), followed by Mucocutaneous Leishmaniasis (4.76%) and Cutaneous Leishmaniasis (2.90%) during 2008-17. In terms of citation impact per paper, Visceral Leishmaniasis registered the highest impact of 16.38, followed by Cutaneous Leishmaniasis (7.52) and Mucocutaneous Leishmaniasis (4.205) during 2008-17.

Profile of Top 15 Most Productive Indian Organizations

Four Hundred Eighty Eight (488) organizations participated in Indian Leishmaniasis research, of which 340 organizations contributed 1-5 papers each, 81 organizations 6-10 papers each, 41 organizations 11-30 papers each, 14 organizations 31-50 papers each, 8 organizations 51-100 papers each and 4 organizations 101-201 papers each during 2008-17.

The productivity of 15 most productive organizations in Indian Leishmaniasis research varied from 39 to 301 publications and together they contributed 78.38% (1544) publication share and 95.86% (32628) citation share to its cumulative publications output during 2008-17. The scientometric profile of these 15 organizations is presented in Table 6.

- Four of these organizations registered publications output greater than the group average of 102.93: Banaras Hindu University, Varanasi (301 papers), Indian Institute of Chemical Biology, Kolkata (258 papers), Central Drug Research Institute, Lucknow (212 papers) and Rajendra Memorial Institute of Medical Sciences, Patna (207 papers) during 2008-17;

Table 4: Subject-Wise Breakup of Indian Publications in Leishmaniasis Research during 2008-17.

S.No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		2008-12	2013-17	2008-12	2008-12	2013-17	2008-17	2008-17	2008-17
1	Medicine	509	583	1092	101.46	98.76	22414	20.53	55.43
2	Biochemistry, Genetics and Molecular Biology	300	349	649	100.62	99.47	9498	14.63	32.94
3	Immunology and Microbiology	310	314	624	108.14	93.08	8340	13.37	31.68
4	Pharmacology, Toxicology and Pharmaceutics	193	217	410	102.47	97.90	6840	16.68	20.81
5	Chemistry	60	93	153	85.36	112.44	3528	23.06	7.77
6	Agricultural and Biological Sciences	76	73	149	111.03	90.63	1875	12.58	7.56
	India's Output	905	1065	1970					

• There is overlapping of literature covered under various subjects
 TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

Table 5: Indian Publication Output by Type of Leishmaniasis Research, 2008-17.

S.No	Type of Anemia	Global			India		
		GTP	TP	TC	CPP	%GTP	%TP
1	Cutaneous Leishmaniasis	2172	63	474	7.52	2.90	3.20
2	Mucocutaneous Leishmaniasis	105	5	21	4.20	4.76	0.25
3	Visceral Leishmaniasis	4923	1076	17626	16.38	21.86	54.62
	Total of India	15995	1970				

GTP=Global Total Papers, TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; ICP=International Collaborative Papers

- Three organizations registered citation impact above the group average of 21.13 citations per publication: All India Institute of Medical Sciences, New Delhi (105.23), Postgraduate Institute of Medical Education and Research, Chandigarh (61.36) and Banaras Hindu University, Varanasi (22.25) during 2008-17;
- Five organizations contributed international collaborative publications share above the group average of 28.43%: Banaras Hindu University, Varanasi (51.16%), Institute of Pathology, New Delhi (50.85%), National Institute of Pharmaceutical Education and Research, Mohali (33.33%), Institute of Postgraduate Medical Education and Research, Kolkata (30.77%) and Jawaharlal Nehru University, New Delhi (30.77%) during 2008-17; and
- Three organizations registered the relative citation index above the group average (1.22) of all organizations: All India Institute of Medical Sciences, New Delhi (6.09), Postgraduate Institute of Medical Education and Research, Chandigarh (3.55) and Banaras Hindu University, Varanasi (1.29) during 2008-17.
- Four authors registered publications output above the group average of 74.93: S. Sundar (243 papers), P. Das (205 papers), K. Pandey (86 papers) and A. Dube (82 papers) during 2008-17;
- Six authors registered impact above the group average of 15.81 citations per publication: J. Chakravarty (35.33), S. Sundar (23.37), N. Ali (20.0), S. Gupta (16.26), S. Roy (16.06), P. Salotra (15.94) during 2008-17;
- Seven authors contributed international collaborative publications share above the group average of 33.10% of all authors: S. Sundar (56.38%), P. Salotra (54.55%), S. Roy (47.06%), V. Kumar (42.86%), N. Ali (40.0%), J. Chakravarty (35.9%) and R. Madhubala (35.14%) during 2008-17;
- Five authors registered the relative citation index above the group average (0.92) of all authors: J. Chakravarty (2.04), S. Sundar (1.35), N. Ali (1.16), S. Gupta (0.94) and S. Roy (0.93) during 2008-17.

Medium of Communication

Seven Hundred Forty Nine (749) journals participated in Indian Leishmaniasis research, of which 440 journals contributed 1-5 papers each, 44 journals 6-10 papers each, 19 journals 11-20 papers each, 11 journals 21-50 papers each and 2 journals 51-84 papers each during 2008-17. Of the total Indian publications output in Leishmaniasis research, 98.53% (1603) appeared in journals, 0.66% (13) in books, 0.56% (11) as book chapters, 0.15% (3) as conference proceedings and 0.25% (2) as trade publications during 2008-17. The top 15 most productive journals accounted for 19 to 84 papers each in India Leishmaniasis research and together accounted for 26.17% share (508 papers) of total journal publication output during 2008-17. The publication share of these top 15 most productive journals decreased from 26.43% to 25.95% between 2008-12 and 2013-17. The top most productive journal (with 84 papers) was

Profile of Top 15 Most Productive Authors

Seven Hundred Forty Nine (749) authors participated in Indian Leishmaniasis research, of which 610 authors contributed 1-10 papers each, 86 authors 11-20 papers each, 45 authors 21-50 papers each, 6 authors 51-100 papers each and 2 authors 101-243 papers each during 2008-17.

The productivity of 15 most productive authors in Indian Leishmaniasis research varied from 37 to 243 publications. Together they contributed 57.06% (1124) Indian publication share and 52.23% (17776) citation share during 2008-17. The scientometric profile of these 15 authors is presented in Table 7.

Table 6: Scientometric Profile of Top 15 Most Productive Organizations in Leishmaniasis Research in India during 2008-17.

S.No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Banaras Hindu University, Varanasi	301	6696	22.25	42	154	51.16	1.29
2	Indian Institute of Chemical Biology, Kolkata	258	3833	14.86	31	70	27.13	0.86
3	Central Drug Research Institute, Lucknow	212	2806	13.24	27	24	11.32	0.77
4	Rajendra Memorial Institute of Medical Sciences, Patna	207	2165	10.46	23	58	28.02	0.61
5	All India Institute of Medical Sciences, New Delhi	82	8629	105.23	17	9	10.98	6.09
6	National Center for Cell Science, Pune	64	615	9.61	13	12	18.75	0.56
7	Institute of Pathology, New Delhi	59	920	15.59	17	30	50.85	0.90
8	Jadavpur University, Kolkata	52	497	9.56	12	10	19.23	0.55
9	Jawaharlal Nehru University, New Delhi	52	698	13.42	16	16	30.77	0.78
10	Postgraduate Institute of Medical Education and Research, Chandigarh	47	2884	61.36	12	12	25.53	3.55
11	Indian Institute of Technology, Guwahati	47	489	10.40	12	3	6.38	0.60
12	National Institute of Pharmaceutical Education and Research, Mohali	42	495	11.79	12	14	33.33	0.68
13	Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi	42	528	12.57	13	11	26.19	0.73
14	Bose Institute, Kolkata	40	654	16.35	14	4	10.00	0.95
15	Institute of Postgraduate Medical Education and Research, Kolkata	39	719	18.44	17	12	30.77	1.07
	Total of 15 Indian organizations	1544	32628	21.13	18.53	439	28.43	1.22
	Total of India	1970	34036	17.28				
	Share of top 15 Indian organizations in India's total output	78.38	95.86					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

Table 7: Scientometric Profile of Top 15 Most Productive Authors in Leishmaniasis Research in India during 2008-17.

S.No	Name of the author	Affiliation of the author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	S. Sundar	Banaras Hindu University, Varanasi	243	5678	23.37	39	137	56.38	1.35
2	P. Das	Rajendra Memorial Institute of Medical Sciences, Patna	205	2277	11.11	24	62	30.24	0.64
3	K. Pandey	Rajendra Memorial Institute of Medical Sciences, Patna	86	984	11.44	16	16	18.60	0.66
4	A. Dube	Central Drug Research Institute, Lucknow	82	1161	14.16	20	4	4.88	0.82
5	P. Salotra	Institute of Pathology, New Delhi	66	1052	15.94	19	36	54.55	0.92
6	S. Gupta	Central Drug Research Institute, Lucknow	58	943	16.26	19	10	17.24	0.94
7	S. Roy	Indian Institute of Chemical Biology, Kolkata	51	819	16.06	19	24	47.06	0.93
8	V.N.R. Das	Rajendra Memorial Institute of Medical Sciences, Patna	48	434	9.04	11	9	18.75	0.52
9	N. Ali	Indian Institute of Chemical Biology, Kolkata	40	800	20.00	19	16	40.00	1.16
10	S. Bimal	Rajendra Memorial Institute of Medical Sciences, Patna	46	369	8.02	10	1	2.17	0.46
11	V.K. Dubey	Indian Institute of Technology, Guwahati	43	479	11.14	12	2	4.65	0.64
12	V. Kumar	Rajendra Memorial Institute of Medical Sciences, Patna	42	453	10.79	13	18	42.86	0.62
13	J. Chakravarty	Banaras Hindu University, Varanasi	39	1378	35.33	18	14	35.90	2.04
14	S. Das	Rajendra Memorial Institute of Medical Sciences, Patna	38	384	10.11	11	10	26.32	0.58
15	R. Madhubala	Jawaharlal Nehru University, New Delhi	37	565	15.27	13	13	35.14	0.88
	Total of 15 Indian authors		1124	17776	15.81	17.53	372	33.10	0.92
	Total of India		1970	34036	17.28				
	Share of 15 authors in India's total		57.06	52.23					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers; RCI=Relative Citation Index

Table 8: Top 15 Most Productive Journals in Leishmaniasis Research in India during 2008-17.

S.No	Name of the Journal	Number of Papers		
		2008-12	2013-17	2008-17
1	PLOS Neglected Tropical Diseases	25	59	84
2	PLOS One	30	39	69
3	Experimental Parasitology	20	22	42
4	American Journal of Tropical Medicine and Hygiene	11	30	41
5	Antimicrobial Agents	13	22	35
6	Parasitology Research	18	13	31
7	Bioorganic and Medicinal Chemistry Letters	11	15	26
8	Tropical Medicine and International Health	19	7	26
9	Journal of Immunology	12	12	24
10	Indian Journal of Medical Research	14	9	23
11	Journal of Antimicrobial Chemotherapy	19	4	23
12	Acta Tropica	8	14	22
13	European Journal of Medicinal Chemistry	11	11	22
14	Indian Journal of Dermatology, Venereology and Leprology	9	12	21
15	Transactions of the Royal Society of Tropical Medicine and Hygiene	16	3	19
	Total of 15 journals	236	272	508
	Total India journal output	893	1048	1941
	Share of top 15 journals in Indian journal output	26.43	25.95	26.17

PLOS Neglected Tropical Diseases, followed by *PLOS One* (69 papers), *Experimental Parasitology* (42 papers), *American Journal of Tropical Medicine and Hygiene* (41 papers), *Antimicrobial Agents* (35 papers), etc. during 2008-17 (Table 6).

High Cited Papers

Out of 1970 papers in Indian Leishmaniasis research, around 1 percent (20, 1.01%) received 102 to 5725 citations per paper in 10 years (2008-17). These 20 highly cited papers together cumulated 211897 citations, with an average of 594.85 citations per paper. Amongst 20 highly cited papers, 14 received 101-200 citations each, 2 received 201-399 citations each, 1 received 490 citations and the remaining 3 papers were in 1421-5725 citation range. These 20 highly cited papers originated from 65 countries. The USA, U.K. and Switzerland accounted for the highest number of papers (6), followed by Belgium (4 papers), Canada, Germany and Nepal (3 papers each), Australia and Bangladesh (2 papers each), etc. Top Indian organizations participating in 20 highly cited papers include Banaras Hindu University (11 papers), All India Institute of Medical Sciences, New Delhi (4 papers), Postgraduate Institute of Medical Education and Research, Chandigarh (2 papers), etc. The leading authors participating in 20 high cited papers were: S. Sundar (8 papers), J. Chakravarty (6 papers, etc. These 20 highly cited papers were published in 16 journals, with 4 papers in *The Lancet*, followed by 2 papers in *Clinical Infectious Diseases* and 1 paper each in *Asia and Pacific Journal of Tropical Medicine*, *Colloid and Surfaces B*, *Expert Opinion in Investigative Drugs*, *Expert Opinion in Pharmacotherapy*, *Genome Research*, *International Journal of Environmental Research and Public Health*, *Journal of Antibiotics*, *Journal of Pharmaceutical Sciences*, *Journal of Vector Borne Diseases*, *Medicinal Research Review*, *New England Journal of Medicine*, *PLOS Neglected Diseases*, *PLOS Pathogens* and *Transactions of the Royal Society of Tropical Medicine and Public Health*.

CONCLUSION

Conclude that as countries in the Indian subcontinent progress towards the elimination goal of Leishmaniasis in the affected regions, the concern is that elimination may be mistaken for eradication, and both donor fatigue and programme complacency may drift attention to the next unfinished agenda. The challenge now is to ensure that the disease does not re-emerge or is not reintroduced and that disease and vector surveillance is reinforced during the post-elimination phase. The strategy needs a paradigm shift from preventing disease to preventing infection and interrupting transmission. The development of innovative approaches to impair infection through early case detection and treatment, particularly in remote or previously non-endemic areas, as well as vector surveillance systems, new methods to measure transmission, mathematical transmission modelling to measure progress post elimination, xeno-diagnostic studies to measure reservoir potential, new non-invasive antigen-based diagnostic tools, better treatment of post kala-azar dermal leishmaniasis and surveillance for drug resistance are some of the urgent research priorities for the immediate future. Further research is needed on insecticide resistance monitoring, sandfly breeding and feeding habits, and the impact of IRS on transmission of Visceral Leishmaniasis between the host and vector. Continuing investment in translational research from the bench to the bedside to public health is imperative to block transmission and prevent a resurgence of Visceral Leishmaniasis in the future.

SUMMARY

- The global research output in the field of Leishmaniasis research had originated from as many as 158 countries, of which the top 10 most productive countries account for 95.57% global publication share during 2008-17, which increased from 92.26% to 98.62% from 2008-12 to 2013-17. Among top 10 countries, Brazil

accounted for the highest publication share (22.95%), followed by USA (17.78%), India (12.32%), U.K., Iran and Spain (from 7.21% to 8.20%), France, Germany, Italy and Switzerland (from 4.13% to 5.95%) during 2008-17. The global publication share in five years increased in Brazil, Iran, Spain, India and Italy, as against decrease in USA, U.K., Spain, Switzerland and Germany from 2008-12 to 2013-17. Seven of the top 10 countries scored relative citation index above the world average of 1.32: Switzerland (2.17), Italy (2.0), U.K. (1.93), France (1.86), USA (1.80), Spain (1.58) and Germany (1.43) during 2008-17. Seven countries have achieved share of high cited papers above the average (1.65) of top 10 countries: U.K. (3.43), USA (3.27), Switzerland (3.03), Italy (2.95), France (2.21), Germany (1.90) and Spain (1.73) during 2008-17.

- India had produced 1970 publications in Leishmaniasis research as indexed in Scopus database in 10 years during 2008-17. These publications increased from 145 to 211 from the year 2008 to year 2017, registering 17.68% annual growth. India's global publications share in Leishmaniasis research was 12.32% during 2008-17, which increased from 11.81% to 12.78% from 2008-12 to 2013-17. India's citation impact in Leishmaniasis research averaged to 17.28 citations per publication during 2008-17, which dropped from 27.07 to 8.96 from 2008-12 to 2013-17. The share of international collaborative papers of India in its research output in Leishmaniasis was 26.85% during 2008-17, which increased from 26.54% to 27.18% from 2008-12 to 2013-17. Medicine, among subjects, accounted for the highest publications share (55.43%), followed by biochemistry, genetics and molecular biology (32.94%), immunology and microbiology (31.68%), pharmacology, toxicology and pharmaceuticals (20.81%), chemistry (7.77%) and agricultural and biological sciences (7.56%) during 2008-17.
- The top 15 most productive Indian organizations and authors together contributed 78.38% and 57.06% respectively as their share of Indian publication output and 95.86% and 52.23% respectively as their share of Indian citation output during 2008-17. The leading most productive Indian organizations contributing to Leishmaniasis research were Banaras Hindu University, Varanasi (301 papers), Indian Institute of Chemical Biology, Kolkata (258 papers), Central Drug Research Institute, Lucknow (212 papers) and Rajendra Memorial Institute of Medical Sciences, Patna (207 papers) during 2008-17. The leading Indian organizations with comparatively higher citation impact per paper were All India Institute of Medical Sciences, New Delhi (105.23), Postgraduate Institute of Medical Education and Research, Chandigarh (61.36) and Banaras Hindu University, Varanasi (22.25) during 2008-17.

- The leading most productive Indian authors contributing to Leishmaniasis research were S. Sundar (243 papers), P. Das (205 papers), K. Pandey (86 papers) and A. Dube (82 papers) during 2008-17. The leading Indian authors with comparatively higher citation impact per paper were J. Chakravarty (35.33), S. Sundar (23.37), N. Ali (20.0), S. Gupta (16.26), S. Roy (16.06), P. Salotra (15.94) during 2008-17.
- Of the 1603 journal publications (published in 749 journals) from India on Leishmaniasis research, the top 15 most productive journals accounted for 26.17% share of total Indian journal publication output during 2008-17, which decreased from 26.43% to 25.95% from 2008-12 and 2013-17. The top most productive journal was PLOS Neglected Tropical Disease (84 papers), followed by PLOS One (69 papers), Experimental Parasitology (42 papers), American Journal of Tropical Medicine and Hygiene (41 papers), Antimicrobial Agents (35 papers), etc. during 2008-17.
- Only 20 papers out of 1970 papers registered citations from 102 to 5725 citations per paper during 2008-17, which together received 211897 citations, leading to an average of 594.85 citations per paper. The USA, U.K. and Switzerland accounted for the highest number of papers (6), followed by Belgium (4 papers), Canada, Germany and Nepal (3 papers each), Australia and Bangladesh (2 papers each), etc. These 20 highly cited papers were published in 16 journals, with 4 papers in The Lancet, followed by 2 papers in Clinical Infectious Diseases and 1 paper each in other 14 journals.

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