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Mapping the Indian Contribution in Pathogen Research during 2008-2017: A Scientometric Analysis

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Mapping the Indian Contribution in Pathogen Research during 2008-2017: A Scientometric Analysis

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Abstract

The present study mainly examines the growth rate of publications in the field of Pathogen research in India during the period of 2008-2017. The study based on Scopus databases and using scientometric tools. It reveals that a total 13070 of publications were published from the marked period of study. our analysis includes the year wise publications output, annual growth rate, compound annual growth rate, relative growth rate and doubling time, most productive authors, documents wise distribution of publications etc., and found that the maximum 1925 (14.73%) of research papers were published in the year 2016, followed by 1896 (14.51%) of publication in 2017. The maximum 36.541 annual growth rate was recorded in the year 2011, and 0.1189 CAGR was recorded in the year 2009. The maximum RGR 0.82 was recorded in the year 2009, and the highest doubling time 4.414 was recorded in the year 2017. The highest 69 publications were contributed by Dhama, K. and the maximum 10909 documents were 'Article' type.

Keywords: Scientometrics, Pathogen Research, Annual Growth Rate (AGR), Compound Annual Growth Rate (CAGR), Relative Growth Rate (RGR) and Doubling Time (Dt.).

1. Introduction

Scientometrics is the measurement of science and is therefore concerned with the growth, structure and productivity of scientific disciplines. According to (Tague-Sutcliffe, 1992), "Scientometrics is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities including, among others, publication, and so overlaps bibliometrics to some extent."

A Pathogen is a disease-causing organism or virus. "A Pathogen is a microorganism, virus, or other substance that causes disease in another organism, the host. The human body contains many natural defences against some of the common pathogens in the form of the human immune system and by some "helpful" bacteria present in the human body's normal flora. There are several substrates including various pathways whereby pathogens can invade a host, but soil contamination has the longest or most persistent potential for harboring a pathogen. Some of the diseases that are caused by viral pathogens include smallpox, mumps, chickenpox, influenza, Ebola, measles and rubella. Diseases caused by organisms in humans are known as pathogenic diseases." https://www.omicsonline.org/scholarly/pathogen-journals-articles-ppts-list.php. The table-1 shows the access type of publications, in which out

of total 13070 publications, 12259 of publications access type other and 811 publications were an open access type.

Table 1: Access Type

Open Access	811
Other	12259
Total	**13070**

2. Literature Review

Amsaveni and HariKrishnan (2018) conducted A Scientometric Analysis of Environmental Management Research Output during (1989–2014). A total of 61877 research papers were recorded from the Web of Knowledge, includes, SSCI, A&HCI, SCI databases from (1989-2014). The study analyses the different pattern of scientometrics such as the year wise distribution of publication, relative growth rate and doubling time, famous journal name, most famous authors, and found that in the year 2014, the maximum number of publication was published, In the year 2001, the highest 99 doubling time was recorded. The most productive author name was Huang GH with 213 records and secure the first rank, followed by Chang NB with 83 records, and got the second position, in the Journal of Environmental Management, the highest 930 articles were published.

Senthil Kumar & Muthukrishnan (2017) carried out a study on a scientometric mapping of publications productivity on the British Journal of Cancer during (2005-2015). The study examine and observed that the most of the publication comes from the UK (31.5%) with a global citation score of 54323, the top twenty most productive institutions involved in Cancer research have contributed together 2653 (38.9%) research papers with an average of 133 research per institution, the most popular keyword "Cancer" has been found during the period of study and this keyword appeared in 3801 (55.70%) research papers by the researchers.

Amsaveni & Ramesh (2016) analyze mapping of research productivity in Forensic Science. A total of 10464 research papers were contributed by scientists from the marked period of study. The study examines and found the relative growth rates have declined from -0.482 in 1989 to 0.04 in 2010, it is also found the degree of collaboration is 0.83, Budowle, B. was the most productive author from Canada and got the rank first, and "Journal of Forensic Science" and "Forensic Science International" were found as the highest research contributing and citations receiving journals during the period of study.

Yeshawant and Ravi (2016) analyse a study on Scientometric Dimensions of Blood Cancer Research from the period of 10 years i.e. (2004-2013). During the period of study, it is observed that a total 1936 record has been found. From the marked period of study, it is also found that the highest number of research papers were published in the year 2012 i.e. 324, followed by 308 publications in the year 2013. 286 (5.49%) of publications were published in the year 2012 by the Indian scientist, followed by 255 (3.93%) of research papers were published in the year 2013. The average 173 of publications per year published in the field of Blood Cancer during the period of study.

Gupta et al. (2016) Analysed a Lung Cancer in India: A Scientometric Study of Publications during (2005-2014). The data was collected by SCOPUS database. The study examined various scientometric pattern like most productive countries, geographical distribution of publication, most prolific authors, most productive journals in India, and found that the highest 51299 papers were contributed by the United States, the most active authors were N. Singh and A K Saxena with 37 of contribution each, followed by C S Pramash with 33 papers contributions.

3. Objectives of the study

The main objectives of the study are to:

1. Identify the Growth rate of publications of pathogen research in India.
2. Analysis of the Annual Growth Rate (AGR) and Compound Annual Growth Rate (CAGR) of publications.
3. Identify the Most Prolific Authors Name
4. Analysis of the documents-wise distribution of publications.
5. Find out the source title and affiliation name.

4. Methodology

The data was collected by the Scopus database, which is a large abstract and citation database of peer-reviewed literature from various disciplines, and it's owned by Elsevier. The following search string (pathogen) limit to India (2008-2017) to be used for collecting the data. A total of 13070 records were found from the marked period of study. These data along with full bibliographical details i.e. Year, Document type, Source title, affiliation etc. The extracted data from the database further processed and analysed by using MS-Excel.

5. Data Analysis

5.1 Year Wise Distribution of Publication

Table 2 and figure 1 shows the year-wise distribution of publication in the field of pathogen research during the period (2008-2017). On the observation of data, it is indicated that in the initial years the output is low, but it started increasing after 2011 and reached a peak in 2017. The highest 1925 (14.73%) of publications were published in the year 2016, followed by 1896, constituting 14.51% published in the year 2017, and the lowest publication 512 (3.92%) were published in the begins year during the period of study.

Table 2: Year Wise Distribution of Publication

Year	Total No. of Publication	Percentage of Publication	Cumulative
2008	512	3.92	3.92
2009	641	4.9	8.82
2010	821	6.28	15.1
2011	1121	8.58	23.68
2012	1368	10.47	34.15

2013	1486	11.37	45.52
2014	1663	12.72	58.24
2015	1637	12.52	70.76
2016	1925	14.73	85.49
2017	1896	14.51	100
Total	**13070**	**100**	

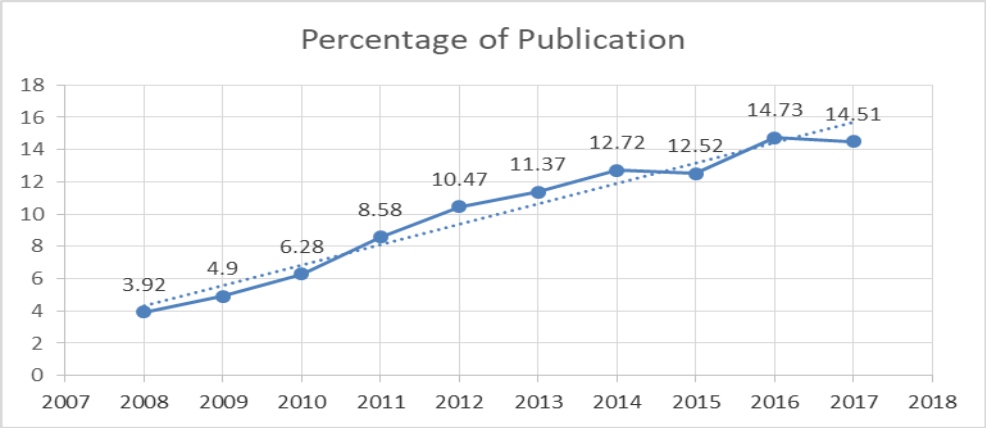

Figure-1: Distribution of Publication

5.2 Document Wise Publication Distribution

Table 3 and figure 2 illustrates the document wise publication distribution on pathogen research publications in India from the marking period of study. During the period of study the maximum 10909 record was article type documents, followed by 1169 research papers was review type documents, and 573 publication was book chapter type documents, conference paper, book, letter, short survey, note, editorial, articles in press, erratum, retracted with 197, 56, 51, 44, 41, 14, 11, 4, 1 research papers respectively.

Table 3: Document Wise Publication Distribution

Article	10909
Review	1169
Book Chapter	573
Conference Paper	197
Book	56
Letter	51
Short Survey	44
Note	41
Editorial	14
Article in Press	11
Erratum	4
Retracted	1
Total	**13070**

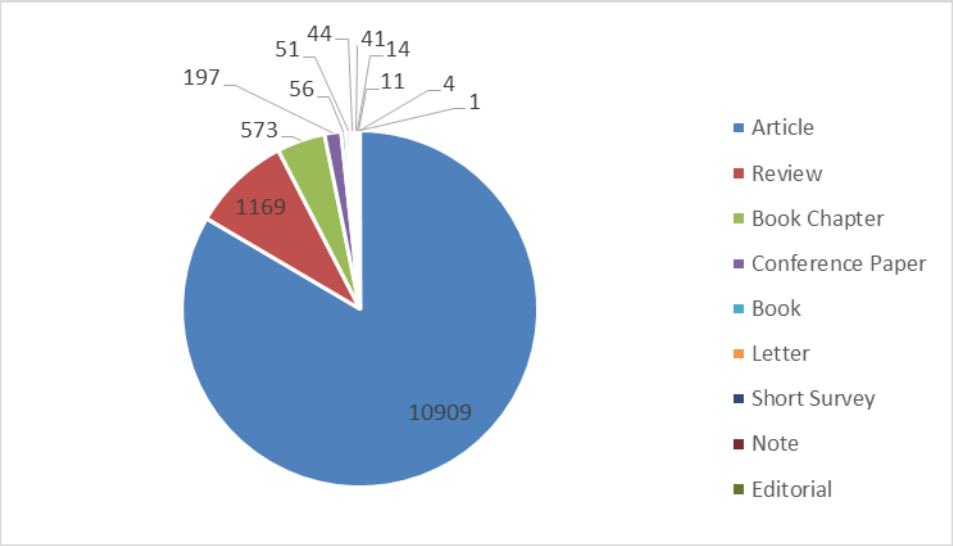

Figure 2: Document Wise Publication Distribution

5.3 Annual Growth Rate of Publications

Table 4 depicts the annual growth rate of publications of pathogen research from the marked period of study. On the observation of table 4, it is clearly shown that the maximum AGR 36.541 was recorded in the year 2011, followed by 28.081 annual growth rate was recorded in the year 2010, and AGR 25.195 in the year 2009. In the below table 4, it showed the overall annual growth rate of publication. The annual growth rate (AGR) are calculated on the formula given by Kumar and Kaliyaperumal, 2015 and mention below:

$$AGR = \frac{EndValue - FirstValue}{FirstValue} \times 100$$

Table 4: Annual Growth Rate of Publications

Year	Total No. of Publication	AGR
2008	512	0
2009	641	25.195
2010	821	28.081
2011	1121	36.541
2012	1368	22.034
2013	1486	8.626
2014	1663	11.911
2015	1637	-1.563
2016	1925	19.593
2017	1896	-1.506

5.4 Compound Annual Growth Rate of Publications

Table 5 illustrates the compound annual growth rate of publications in the field of the pathogen (2008-2017). The compound annual growth rate is calculated by taking the n^{th} root of the total percentage growth rate, where n is the number of years in the period being considered. The maximum 0.1189 CAGR was recorded in the year 2009, followed by 0.08599 recorded in the year 2010, and 0.08097 CAGR was recorded in the year 2011. The

lowest -0.002 CAGR was recorded in the year 2015. The overall compound annual growth rate of publication shown in below table 5.

The compound annual growth rate was calculated by the following formula available on https://www.investopedia.com/terms/c/cagr.asp).

$$\mathbf{CAGR} = [(\mathbf{EndingValue} / \mathbf{BeginningValue})^{1/n} - 1]$$

Table 5: Compound Annual Growth Rate of Publications

Year	Total No. of Publication	Cumulative Frequency	CAGR
2008	512	512	0
2009	641	1153	0.1189
2010	821	1974	0.08599
2011	1121	3095	0.08097
2012	1368	4463	0.04063
2013	1486	5949	0.01389
2014	1663	7612	0.01621
2015	1637	9249	-0.002
2016	1925	11174	0.01817
2017	1896	13070	-0.0015

5.5 Relative Growth Rate and Doubling Time of Publication

Table 6 and figure 3 shows the relative growth rate and doubling time of publication in pathogen research during the period (2008-2017). The growth rate of all publication has been measured on the basis of RGR and Dt model, the particular model is developed by Mahapatra in 1985. RGR is calculated to analyse the increase in the number of publications on time and the Dt is directly related to RGR. The mathematical representation of the mean relative growth rate of articles over a specific period is derived from the following formula:

$$RGR = \frac{W2 - W1}{T2 - T1}$$

Where,

RGR = Growth Rate over the specific period of the interval,
W1 = Log_e (natural log of the initial number of contributions)
W2 = Log_e (natural log of the final number of contributions)
T1 = the unit of initial time
T2 = the unit of final time

The maximum RGR 0.82 was recorded in the year 2009, followed by 0.538 RGR was recorded in the year 2010, and the highest doubling time 4.414 was recorded in the year 2017, followed by 3.667 Dt. was recorded in the year 2016. The overall data related to relative growth rate and doubling time of publication has been shown in below table 6.

Doubling Time

From the calculation, it is defined that there is a direct equivalence existing between the RGR and Dt. If the number of contributions of a subject doubles, from (2008-2017), then the difference between the logarithm of the numbers at the starting and at the last of the period

must be the logarithms of the number 2. If one uses a natural logarithm, this difference has a value of 0.693 (Beaie and Acol, 2009).

$$DoublingTime(Dt) = \frac{0.693}{R}$$

Table 6: Relative Growth Rate and Doubling Time of Publication

Year	Number of Publications	Cumulative Sum	W1	W2	RGR	Dt
2008	512	512	0	6.24	0	0
2009	641	1153	6.24	7.05	0.82	0.85
2010	821	1974	7.05	7.588	0.538	1.288
2011	1121	3095	7.588	8.038	0.45	1.54
2012	1368	4463	8.038	8.404	0.366	1.893
2013	1486	5949	8.404	8.699	0.295	2.349
2014	1663	7612	8.699	8.937	0.238	2.912
2015	1637	9249	8.937	9.132	0.195	3.554
2016	1925	11174	9.132	9.321	0.189	3.667
2017	1896	13070	9.321	9.478	0.157	4.414

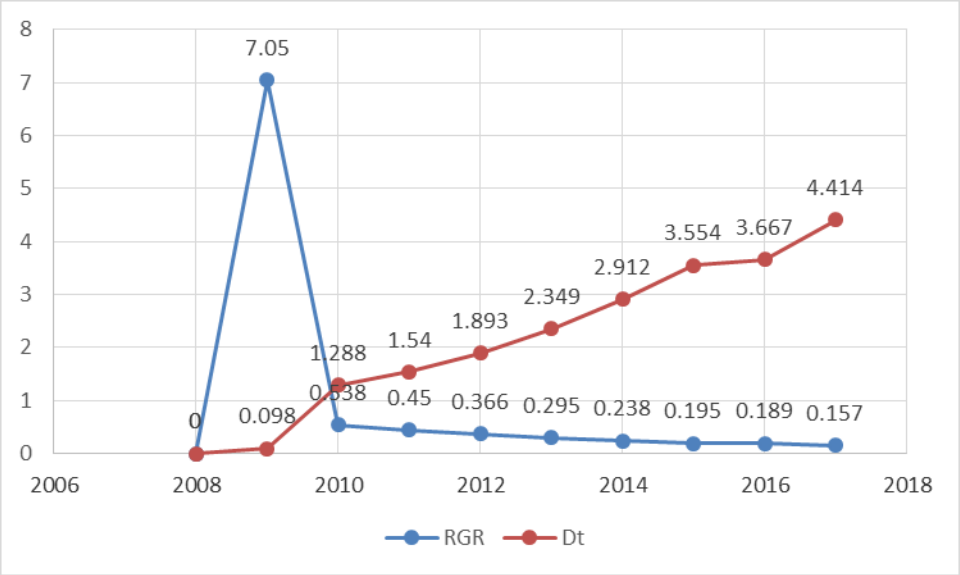

Figure 3: Relative Growth Rate and Doubling Time of Publication

5.6 Most Productive Authors

Table 7 depicts the most productive author's name in pathogen research publication during the period of 10 years i.e. (2008-2017). The particular table which is given below show that the authors who have published 33 or more research papers from the marked period of study. The highest 69 publications were contributed by Dhama, K., followed by Ramamurthy, T. with 49 publications, and 45 publications were contributed by Benelli, G. Rest 355 publications were contributed by 10 authors, which has been shown in below table 7.

Table 7: Most Productive Authors

Authors Name	Total No. of Publications
Dhama, K.	69
Ramamurthy, T.	49
Benelli, G.	45
Pandian, S.K.	41
Singh, H.B.	38
Chakravortty, D.	37
Chowdhary, A.	36
Viswanathan, R.	36
Harikrishnan, R.	35
Abraham, J.	33
Chhibber, S.	33
Rai, M.	33
Shetty, H.S.	33

5.8 Most Common Journals used by Indian Scientists

Table 9 shows the most common journals used by Indian scientists for publishing their research results. The particular table showed that the credibility of Plos one is very high out of total, 262 of publications were contributed by Indian scientists, followed by the publications were published in International Journal of Pharma and Bio Sciences is slightly different from 'Plos one' with 256 publication, and Journal Of Pure And Applied Microbiology published 251 research results during the period of study.

Table 9: Most common journals used by Indian scientists

Name of Journals	No. of Publication
Plos One	262
International Journal Of Pharma And Bio Sciences	256
Journal Of Pure And Applied Microbiology	251
International Journal Of Pharmacy And Pharmaceutical Sciences	189
Journal Of Clinical And Diagnostic Research	189
Archives Of Phytopathology And Plant Protection	175
Asian Journal Of Pharmaceutical And Clinical Research	150
Frontiers In Microbiology	104
Scientific Reports	100
Research Journal Of Pharmaceutical Biological And Chemical Sciences	99

5.9 Affiliation Name

Table 10 illustrates the publication on 'pathogen research' by affiliation institutions. The analysis data on the distribution of output by different institutions indicates that the maximum 321 records were published by Indian Council of Agricultural Research, followed by Indian Agricultural Research Institute with 263 contributions, and 256 publications were contributed by Council of Scientific and Industrial Research India, and the share of Banaras Hindu University was 242 papers. The overall data of affiliation name has been shown in below table 10.

Table 10: Top 10 Affiliation Name

Affiliation	No. of Publication
Indian Council of Agricultural Research	321
Indian Agricultural Research Institute	263
Council of Scientific and Industrial Research India	256
Banaras Hindu University	242
Indian Institute of Science, Bangalore	224
Indian Veterinary Research Institute	222
Vellore Institute of Technology	220
University of Delhi	214
Annamalai University	203
Bharathidasan University	189

6. Conclusion

Pathogens are infectious agents like a bacterium, virus, fungus or parasite, which cause disease when they colonize a host organism. "The microorganisms that are transmitted form the human blood and cause diseases in humans. Pathogens are included in the microorganism but are not limited. Some of the viruses that include in the bloodborne pathogens are hepatitis B, hepatitis C and human immunodeficiency virus. In order to reduce the bloodborne pathogens, the human must implement an exposure control plan in the worksite and should take the protective measures. Pathogens are the chain of infections that cause diseases. In our daily life, we come in contact with pathogens in most of the times our body's immune system will destroy them before they cause any harm to the body. It is also known as disease-causing microorganisms."

The scientometric analysis is increasingly used for research assessment. We aimed to perform a scientometric analysis of research productivity in the field of Pathogen Research during the period of 10 years i.e. (2008-2017). After the analysis it is clearly shown that the maximum research papers were published in the year 2016, followed by 2017. The maximum Annual Growth Rate (AGR) and Compound Annual Growth Rate (CAGR) was recorded in the 2011 and 2009 respectively. The maximum Relative Growth Rate (RGR) and Doubling Time (Dt.) was recorded in the year 2009 and 2017 respectively. The most productive was Dhama, K. The maximum record was article type documents, and the maximum publication's source title was Plos One during the period of study.

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