

Elisa (Enzyme Linked Immunosorbent Assay) Research In Global: A Scientometric Assessment During 1972-2017

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Abstract

The Study analysis the research activities on ELISA (Enzyme Linked Immunosorbent Assay), based on the total publication output. The data is retrieved from the CAB Direct Online Database for 45 years (1972–2017). Types of documents, language, rank lists of journals, most productive authors, a ranking of countries based on their publication output are presented.

Keywords: *Enzyme, ELISA, Scientometric, CAB Direct, Diseases, Mean Absolute Deviation, M.A.D.*

1. Introduction

ELISAs were first created in the mid 1970s as a swap for radioimmunoassay. They stay in wide use in their unique arrangement and in extended configurations with changes that take into account various analyses per well, exceedingly touchy readouts, and direct cell-based yield. ELISA is a groundbreaking strategy for recognition and quantization of natural substances, for example, protein, peptides, antibodies, and hormones. The plate is covered with a catch immunize. A test is then included, and any antigen present ties to catch immune response.

2. Objective of the Study

To analyse the research activities on ELISA based on the total publication output, its growth rate, types of publications, top journals publishing papers on ELISA research, most productive authors and ranking of countries based on publication output on ELISA research.

3. Materials and Methods

The study is based on the published data on ELISA research, retrieved from the CAB Direct Online database for 45 years (1972-2017). Coverage includes leading bibliographic database CAB abstracts and global health, and databases from

internet resources and abstract journals. CAB Direct provides access to:

- Over 11.5 million bibliographic records
- Over 350,000 full text articles hosted by CABI and
- Many other authoritative reviews, news articles and reports

CAB Direct has a clean, simple design and a Google like search functionality to enable the users to find what is needed quickly and easily. The Advanced Search facility of the CAB Direct Online database was used for this study. The keyword 'ELISA' has been used in article tile field and the search was performed.

4. Review of Literature

Scientometric researches have carried out earlier through one of a kind author on the exclusive individual journal publications and literature on particular difficulty areas. The following studies associated with the objectives of this study were reviewed.

Gupta B.M and Dhawan S.M (2018) observed that the present examination inspected Indian yield of 4402 papers in apply autonomy explore, as ordered in Scopus database amid 2007-16, with a view to comprehend India's development rate, worldwide offer, reference affect, global collective papers share, dissemination of distributions by expansive subjects, efficiency and also talk about the reference profile of best associations and creators, favoured correspondence media and attributes of high referred to papers. India enrolled 24.84% development, 2.21% worldwide distributions share, 9.63% universal communitarian productions share, and arrived at the midpoint of 4.13 references for every paper amid the period.

Software engineering was the most taken after subject for mechanical technology inquire about with 67% distributions share, trailed by designing (52.34%), arithmetic (12.81%), and so forth. Top 50 gainful associations and creators have a place with scholastic and R&D divisions and they represented 61.93% and 26.94% distributions share and 70.54% and 35.48% references share in Indian mechanical technology look into yield. Top 25 most gainful diaries represented 41.38% offer of 1566 diary papers distributed in mechanical autonomy look into by India. India contributed just 16 very referred to papers with 100 to 368 references for every paper.

Kumaravel J.P.S, Pricilla Rani P and Kalai Selvi S (2013) reported that the reason for this examination is to lead a scientometric investigation of the assemblage of writing on automated prescription secured by PubMed database for a period from 2000-2011 and recognize the quantum of transient and continuant writers. A sum of 9906 articles were downloaded from PubMed database utilizing the pursuit term apply autonomy in work headings subjected to scientometric information examination strategies. Various research questions relating to distribution recurrence, nation of production, singular profitability of creators, continuant, and transient nature of creators were proposed and replied. In light of the discoveries, numerous ramifications rose that enhance one's comprehension of the personality of mechanical drug as an unmistakable biomedical field. The pool of articles is drawn from PubMed database just however there are different databases moreover.

Ahmed M (2012) has shown diary of Scientometric Research (JSCIRES) is a globally focused on official production of SciBiolMed. Organization. It likewise gets bolster from Pharmacognosy Network Worldwide and INPHARM Association. The second issue onwards i.e. from January 2013 will be distributed with Medknow (www.medknow.com) which is presently converged with Wolters Kluwer's Health.

Anil Sagar, Basavaraj Shivappa Kademani and Karanam Bhanumurthy (2015) this study focused to feature the development and improvement of dull vitality writing and make the quantitative and subjective evaluation by method for breaking down different highlights of research yield in light of Web of Science database. An aggregate of 5858 productions were distributed on dim vitality, which got 157,581 references amid 1999-2011. The normal number of productions every year was 450.62, and the normal number of references per distribution was 26.90. The

productions topped in 2011 with 934 distributions, and the most noteworthy number of references (26,404) were gotten in 2003. There were 3857 (65.84%) single nation distributions from 74 nations and 2001 (34.16%) multi nation shared productions. The most noteworthy number of productions were from Europe with 3723 (41.15%) distributions and 126,747 (39.88%) references taken after by Asia with 2614 (28.89%) distributions and 63,267 (19.90%) references, and North America with 1980 (21.89%) productions and 105,132 (33.08%) references. European researchers have been assuming an essential job on dim vitality related research taken after by Asian Scientists. The exponential development of distributions was seen amid the period. USA had the most astounding offer (26.84%) of productions took after Peoples Republic of China with 13.74% distributions, England with 11.71% distributions, Italy with 10.84% productions, Spain with 7.90% distributions, Germany with 7.27% productions, and India with 7.07% distributions. Cosmology and Astrophysics represents the biggest offer 3920 (66.92%) of distributions in the aggregate overall yield on dim vitality which got 117,919 (74.83%) references taken after by Multidisciplinary Physics with 1242 (21.20%) productions, 29,775 (18.90%) references and 23.97 normal references for each distribution. Over 80% of the distributions seemed just in 15 key diaries.

Gupta B.M, Dhawan S.M. and Ritu Gupta (2014) developed an analyzes world distributions yield via web-based networking media investigate (46354) distributed amid 2001– 2014. The productions information, sourced from Scopus database, arrived at the midpoint of yearly 14.61% development. The paper profiles top 25 most gainful associations that represented 12.46% world offer, and best 25 most profitable creators that represented 2.34% world offer on markers, for example, normal profitability, references per paper, h file, and offer of universal cooperative productions amid 2001– 2014. The conveyance of world yield by nation of production is profoundly skewed. The best 15 most profitable nations represent heft of the world yield (82.40%). The USA has developed as the world pioneer both in its reality offer and references effect of internet based life inquire about yield. Online journals, among internet based life destinations, represented the biggest production share 27.45%, trailed by Facebook (16.75%), Twitter (15.86%), Wikipedia (10.58%), YouTube (7.24%), Flickr (3.94%), MySpace (1.73%), LinkedIn (1.21%), and so on., amid 2001– 2014. Software engineering represented the most noteworthy productions share (55.22%) of world distributions yield via web-based networking media, trailed by sociologies

(26.55%), designing (13.52%), solution (10.14%), business, administration and bookkeeping (8.72%), expressions and humanities (5.95%), brain research (3.68%), and so forth., amid 2001–2014. The best 30 most profitable diaries, which detailed online life, look into amid 2001–2014, represented 6.46% world offer. A sum of 266 were found as profoundly referred to papers in online networking research (0.57% world offer), every we referred to at least 100 times since production till February 2015. Together these profoundly referred to papers accounted 57462 references, with a normal of 216 references for every paper.

Bala, Madhu and Singh Mahender Pratap (2014) estimated the scientometric is part of Science. Scientometric clarify about information and yield assets in term of hierarchical structure. Scientometric is the Science of estimating and breaking down Science. Present day Scientometric is generally in light of crafted by Derek J.de Solla Price and Eugene Garfield. This paper fundamentally investigations 316 insightful interchanges distributed in the Indian Journal of Biochemistry and Bio-Physics. Indian Journal of Bio-Chemistry and Bio-Physics, in the past known as IJBB. It is an associate assessed, open access bio-month to month Journal distributed by NISCAIR. The examination covers predominantly the quantity of articles, type of record refered to, most refered to Journals and so forth. Study uncovers that solitary writer contributed 18 (5.7%) while whatever is left of 162 (51.3%) articles were contributed by Multi writers. The commitments in this Journal from India are somewhat more than those from alternate nations. The destinations of this examination to help the gathering improvement with a specific end goal to satisfy the necessities of researchers and research researchers in the field of science and innovation.

Rajendran Lakshmanan (2015) studied the publication output within the field of elephant analysis as indexed in CAB Direct Online database covering the period (1959-2013). It reports on India's comparative strength in world science and technology output during this field. It is observed a complete of 5,148 publications was published throughout the year (1959-2013) as per CAB Direct Online. The common range of publications published per year was 109 papers. The highest number of 298 papers was published within the year 2013. The study reveals that India is the top country in elephant analysis with its contribution of 838 papers that is sort of (16.27%) of the

worldwide research output on elephant analysis followed by Egypt with 480 papers (9.32%). Saudi Arabia ranks third position with 361 papers (7.01%). The foremost, well-linked journals by the scientists concerned with elephant analysis were: Journal of Camel Practice and Analysis with 846 papers (16.43%) followed by Assist Veterinary Medical Journal with 249 papers (4.84%). The study revealed that out of top five most well-linked journals by the elephant researchers, three journals viz., Indian Journal of Animal Sciences 242 papers (4.70%) and Indian Veterinary Journal 198 papers (3.85%) are published from India which clearly indicates that the contribution of India in elephant analysis is important. The highest medium of communication is journal article with 4,552 papers (88.42%) followed by conference papers with 233 papers (4.52%). Miscellaneous ranks third position with 153 (2.97%). It is observed that English is the most preferred language utilized by the researchers for communication of elephant research with 6939 papers (86.66%) followed by French with 244 (4.73%). Wernery, U. is the most prolific author of elephant analysis who has published 132 papers (2.56%) followed by Faye B with 128 papers (2.48%). It is observed that out of the five authors who contributed a lot of papers in elephant analysis, there are Indians viz., Wernery, U. 132 papers (2.56%), Sahani, M.S. 96 papers (1.86%) and Khanna, N.D. 77 Papers (1.46%).

5. Results and Analysis

5.1 Calculate Mean Absolute Deviation (M.A.D) of Research Output

It is observed from the study that the number of papers has been increasing gradually, i.e. 1 to 1920 papers were published in 1972-1998; because of the research out has been changed in this study. A study of the ELISA research output is a calculate mean absolute deviation (M.A.D) of overall analyzing the research and development in the field [2]. Table-1 shows that the ELISA research output, it is clear that the period has 1972 (1) has less publication in that period, particularly that year was started in research outgrowth in an area, but slowly decreasing Data value of that particular period in 1972-1990. Where \sum is a total number of publications: data value obtained from the mean divided by the number of values. The M.A.D value for the period 1972-2017 is worked out to 1041.56.

Table1. Mean Absolute Deviation of Overall Research Output

Year	No. Of Articles (Σ)	Data Value – Mean
1972	1	1763.23
1973	2	1762.23
1974	6	1758.23
1975	14	1750.23
1976	31	1733.23
1977	52	1712.23
1978	132	1632.23
1979	204	1560.23
1980	300	1464.23
1981	375	1389.23
1982	480	1284.23
1983	594	1170.23
1984	720	1044.23
1985	738	1026.23
1986	854	910.23
1987	1115	649.23
1988	1453	311.23
1989	1497	267.23
1990	1620	144.23
1991	1690	274.23
1992	1655	109.23
1993	1686	78.23
1994	1583	181.23
1995	1678	86.23
1996	1826	61.77
1997	1915	150.77
1998	1920	155.77
1999	1841	76.77
2000	1803	38.77
2001	1787	22.77
2002	1844	79.77
2003	1962	197.77
2004	2091	326.77
2004	2374	609.77
2005	2378	613.77
2006	2884	1119.77
2007	3194	1429.77
2008	3362	1597.77
2009	3561	1796.77
2010	3678	1913.77
2011	4120	2355.77
2012	4171	2406.77
2013	4180	2415.77
2014	4285	2520.77
2015	4119	2354.77
2016	3895	2130.77
2017	1249	515.23
	82919	48953.69

The Mean Absolute Deviation (MAD) of a set of data is the average distance between each data value and the mean. While we could work through each of these steps on the calculator’s home screen, let’s, instead, try to utilize the calculator’s features to minimize our work. We will look at two different approaches to find the population MAD.

$$\text{Mean of the data set} = \frac{82919}{47} = 1764.23$$

Sum of |Data Value – Mean|= 48953.69

$$\text{M.A.D} = \frac{\Sigma|\text{data value} - \text{mean}|}{\text{Number of Values}}$$

$$\text{M.A.D} = \frac{48953.69}{47} = 1041.56$$

The average cost difference between

The orders and the mean order is 1041.56

5.2. Rank-wise Indian States Distribution of Publications

The study reveals that China is the first position in global research output in ELISA followed by South Africa. India is the fourth position in ELISA research out of hundred countries, with its contribution of 2,551 papers which is nearly (3.07%) of the global research output of ELISA research followed by the specific country are in Brazil, with 2300 papers (2.77%) ranks 5th position [4]. It covers India is a 4th level in the field of ELISA research out of the country, Tamil Nadu 227 papers has contributed (0.27%), Southern States are ranked first place in India. The top 10 Country based on number of publications is furnished in Table -2.

Table – 2. Ranking Country Wise in ELISA Analysis

Name of the States	No. of Publications	Percentage	Rank
China	3402	4.10	1
South Africa	2987	3.60	2
USA	2844	3.42	3
India	2551	3.07	4
Brazil	2300	2.77	5
Iran	1406	1.69	6
Italy	1265	1.52	7
Turkey	1233	1.48	8
Germany	1155	1.39	9
Europe	1002	1.20	10

5.3. Preferred Journals

The most popular journals by the scientists concerned with the ELISA analysis were: Plant disease with 1037 papers (1.25%) followed by the Veterinary Parasitology with 983 papers (1.18%). The study revealed that out of high five most popular journals by the ELISA researchers [5], three journals viz., Veterinary Microbiology and

Journal of Clinical Microbiology 933 papers (1.12%) and 822 papers (0.99%), Journal of Virological Methods 816 papers (0.98%). The highest 10 most popular journals are listed in Table- 3 with the amount of papers revealed.

Table – 3. Preferred Journals by ELISA Analysis

Sl.No.	Journal Name	No. of Papers	Percentage
1.	Plant disease	1037	1.25
2.	Veterinary Parasitology	983	1.18
3.	Veterinary Microbiology	933	1.12
4.	Journal of Clinical Microbiology	822	0.99
5.	Journal of Virological Methods	816	0.98
6.	PLos One	756	0.91
7.	Acta Horticulture	669	0.80
8.	Vaccine	667	0.80
9.	Veterinary Record	630	0.75
10.	Journal of Agricultural and Food Chemistry	624	0.75

5.4. Leading format of Publication

The study reveals that the main source of publications coated by CAB Direct Online database for ELISA analysis [7] is journal articles with 75,053 papers (90.5%) followed by conference papers with 5283 papers (9.98%). Book chapter third position with 778 (0.93%), Thesis and Correspondence are within the fourth and fifth places with 492 (0.59%) and 485 (0.58%) various. The highest 9 varieties of publications are furnished in Table -4.

Table – 4. Leading format of Publication

Sl.No.	Kinds of Document	No. of Papers	Percentage
1.	Journal article	75053	90.5
2.	Conference paper	5283	9.98
3.	Book chapter	778	0.93
4.	Thesis	492	0.59
5.	Correspondence	485	0.58
6.	Miscellaneous	363	0.43
7.	Abstract Only	243	0.29
8.	Annual report	106	0.12
9.	Bulletin Article	96	0.11
10.	Editorial and Patent	20	0.02

5.5. Most Productive Authors

The study reveals that Zhang is that the most ranking authors of ELISA analysis who revealed 356 papers (0.42%) followed by Wang, Y with 326 papers (0.39%). It's observed that out of the highest five authors who contributed a lot of papers in ELISA analysis, there are world ranking author contributed a paper level of 194 to 356 viz., UK CAB International, Li, Y and Liu Y, 275 papers (0.33%) and 265 papers (0.31), are a little difference between the two authors and fifth position [6] of the author Wang J has published 247 Papers (0.29%) out of ten authors. Table – 5 lists the highest 10 ranking authors within the field of ELISA analysis.

Table –5. Most Productive Authors in ELISA Analysis

Sl.No.	Name of Author	No. Of Papers	Percentage
1.	Zhang	356	0.42
2.	Wang Y	326	0.39
3.	Li Y	275	0.33
4.	Liu Y	265	0.31
5.	Wang J	247	0.29
6.	Li J	236	0.28
7.	Wang L	218	0.26
8.	Zhang J	199	0.23
9.	Liu J	194	0.23
10.	Li H	190	0.22

5.6. Language Distribution

It is observed that English is the most predominant language used by the researchers for communication in the ELISA analysis with 64498 papers (77.78%) followed by Chinese by 8544 (10.30) and German with 1646 (1.98%). The top 10 predominant languages are furnished in Table - 6.

Table –6. Language Distribution of ELISA Analysis

Sl.No.	Language	No. of Papers	Percentage
1.	English	64498	77.78
2.	Chinese	8544	10.30
3.	German	1646	1.98
4.	Spanish	1501	1.81
5.	French	1163	1.40
6.	Portuguese	1109	1.33
7.	Italian	761	0.91
8.	Turkish	500	0.60
9.	Polish	472	0.56
10.	Persian	462	0.55

6. Findings

These are the findings of the Scientometric study and it is hoped this finding is likely to be helpful for the stakeholders of ELISA analysis knowledge managers in these areas:

- Indian contribution to global ELISA research based on CAB Direct Online database revealed that India has published 2551 papers in the specialization of ELISA analysis.
- The study reveals that Zhang is that the most ranking authors of ELISA analysis who revealed 356 papers (0.42%) followed by Wang, Y with 326 papers (0.39%).
- Most preferred journals are: Plant disease with 1037 papers (1.25%) followed by the Veterinary Parasitology with 983 papers (1.18%). The study revealed that out of high five most popular journals by the ELISA researchers, three journals viz., Veterinary Microbiology and Journal of Clinical Microbiology 933 papers (1.12%) and 822 papers (0.99%), Journal of Virological Methods 816 papers (0.98%).
- Journal articles with 75,053 papers (90.5%) followed by conference papers with 5283 papers (9.98%). Book chapter third position with 778 (0.93%), Thesis and Correspondence are within the fourth and fifth places with 492 (0.59%) and 485 (0.58%) various.
- India is the fourth position in ELISA research out of hundred countries, with its contribution of 2,551 papers which is nearly (3.07%) of the global research output of ELISA research followed by the specific country are in Brazil, with 2300 papers (2.77%) ranks 5th position. It covers India is a 4th level in the field of ELISA research out of the country, Tamil Nadu 227 papers has contributed (0.27%), Southern States are ranked first place in India.

7. Conclusion

During forty five years, of time length worldwide commitment in productions is fundamentally expanded in the field of ELISA investigate. An investigation of the ELISA look into yield is a

Mean Absolute Deviation (MAD) of, by and large breaking down the innovative work in the field. The ELISA investigate yield, plainly the period has 1972 (1) has less distribution in that period, especially that year was begun in inquire about outgrowth in a zone, however gradually diminishing data estimation of that specific period of 1972-1990. China is the principal position in worldwide research yield in ELISA taken after by South Africa. India is the fourth positions in ELISA investigate out of hundred nations, with its commitment of 2,551 papers. In Global research ELISA commitment has used commitment is more compelling and effective, in view of the Indian commitment must be enhanced in ELISA.

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