'ALZHEIMER' RESEARCH IN INDIA DURING THE PERIOD 2010 TO 2019: A SCIENTOMETRIC STUDY

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Abstract

The present study focuses on the research output of 'Alzheimer' disease research in terms of publications output during the period of 2010-2019. The data was collected using the Scopus database. The study examines and analysis various scientometrics parameters and found that the maximum 620 papers were published in 2019 with Annual Growth Rate 3.16 and Compound Annual Growth Rate 0, followed by 601 papers in 2018 with Annual Growth Rate 18.54 and Compound Annual Growth Rate 0.02. The highest 29.55% publications from Biochemistry, Genetics, and Molecular Biology subject area and the maximum 2368 of total publications records were journaled articles while the significant keyword was 'Alzheimer Disease'. In the top 20 organizations in which a maximum of 109 (8.07%) of publications were contributed by Panjab University. Kamal, M.A from King Abdulaziz University, Jeddah, Saudi Arabia has got the highest 33 h-index against 43 publications. The relative growth rate of publication has shown a declined trend, consequently, the mean doubling time for publication of Alzheimer's disease has shown an increasing trend. The relative growth rate was shown in a decreasing trend while the doubling time recorded in an increasing trend. A total of 3944 research papers 74547 of citations were recorded from the marked period of study. The highest research papers were contributed by more than four authors'. It is observed that the overall productivity of Alzheimer's disease by 2019 authors ranks the first position and their Collaborative Coefficient and Modified Collaborative Coefficient have been calculated as 0.62 and the highest Collaborative Index is of the year 2017 i.e. 3.39 during the period under study.

KEYWORDS: Scientometrics, Bibliometrics, Alzheimer Disease, Dementia, Alzheimer, Memory Loss.

1. INTRODUCTION

Scientometrics is the analysis of measuring science. It is the quantitative study of the characteristics of science and scientific research. Scientific study is carried on at fixed intervals for the evaluation of the research process and for granting funds to the research institutions. Research methods include various approaches such as qualitative, quantitative, and computational approaches. Alzheimer's disease is the most common form of dementia and is a degenerative disorder of the brain that leads to memory loss. It is characterized by a continuous decrease in cognitive functions. This disease loses the ability to encode new memories. Ultimately, both declarative and non-declarative memory is impaired due to which the capacity of thinking, reasoning, abstraction, and

language is continuously decreased. Alzheimer's disease is the fifth leading cause of death in industrialized nations after cardiovascular disease, cancer, and stroke. A total of 3944 publications were recorded in which only 795 research papers were open access while 3149 publications were other types accessible during the period of study.

2. LITERATURE REVIEW

Pozo, Aldridge & Zhang (2017) conducted a bibliometrics and scientometrics analysis of four decades (1975-2014) of research in Alzheimer's disease. The data was collected by performing searches in available databases such as Scopus, Web of Science, PubMed, and Alzheimer's Funding Analyzer for the period 1975-2014 and examine a curve fitting analysis with non-linear regression. The number of patents per year is declining after peaking in the late 2000s as the rate and impact of publications progress to increase. The area which is growing at the fastest pace is genetics whereas therapy and pathophysiology have not grown further in the last decade. The role of microglia, inflammation, and synapse are research topics that are growing with great interest. For prevention policy, diet, exercise, and education are gaining momentum whereas MSAIDs and statins have lost the position they once had.

Chen, Wan, Jiang & Cheng (2014) conducted a bibliometric study of cholinesterase inhibitors that were used to find the trend of Alzheimer's disease research and the order of the drugs which was more effective in Alzheimer's disease treatment. A total of 4,982 articles and reviews are collected from the Science Citation Index for the period (1993-2012) was analyzed. The publication of cholinesterase inhibitor research increased overall in this period. Chinese Academy of Science had most publications, followed by the University of California, San Diego and the Hebrew University of Jerusalem stands 1st with the highest average citation per paper and the highest h-index respectively. In cholinesterase inhibitors research, Pharmacology, Chemistry, and Neurosciences were ''raising'' subject categories. The order of drugs that were most effective in the treatment of Alzheimer's disease might be galantamine donepezil, tacrine, memantine, huperzine A and rivastigmine and memantine is now especially used for curing acute dementia.

Gupta & Bala (2013) conducted a scientometrics study of publications on Alzheimer's disease in India for the period 2002-11 and the data was collected by using the Scopus database. It was found that India stands at 16th position among the top 20 countries with a global share of 1.33% which rises from 0.39% in 2002 to 2.36% during 2011, followed by an annual average publication growth rate of 31.92%. Its citation impact per paper was 5.81 which decrease from 8.85 in 2002-06 to 2007-11 and its international collaborative publications share was 24.00% during 2002-11 which decreases from 30.09% in 2002-06 to 2007-11.

Padma, Meenakshi & Ramasamy (2013) presented a study on scientometrics analysis of research productivity in Alzheimer's disease. The data was collected for the period between 1984 and 2012 from the articles published in MEDLARS. The study covers a total of 75115 records, including all the communication channels used by scientists. According to the study, in 1984, this disease has been identified and only one article is being published and then from 1985, this area has gained momentum with total articles of 42480. The growth rate of Alzheimer's disease varies in all years and there is a negative growth rate of the year 1997, 2001,2002, 2005, and 2012 and the average growth rate of

all these is -0.03. The total journals that have contributed to the Alzheimer's disease are 3326, 13 journals are core journals and the highest productivity is in the "Journal of Virology". The publications on Alzheimer's disease are mostly in journals from European countries and India stands at 13th position.

Gupta, Kaur & Kshitig (2011) have attempted to analyze dementia research output from India from 2002-11 through a scientometric study. The results of the study showed that the global publication share has increased over the years, rising from 0.54% in 2002 to 2.20% during 2011. The citation impact per paper was 5.11 during 2002-11, which decreased from 7.29 during 2002-06 to 4.33 during 2007-11. Its international collaborative publications share was 24.54% during 2002-11, which decreased from 28.57% during 2002-06 to 23.07% during 2007-11. Publications of India is less considering that 3.7 million people are suffering from dementia.

Sorenson (2009) conducted a scientometric study to provide a detailed list of the impact of the top 100 investigators in the field of Alzheimer's disease. The availability of online databases of scientific literature and natural language processing (NLP) large scale bibliometric studies within the field of scientometrics. By using Thomson analysis and NLP techniques of the role of Alzheimer's disease within the neurosciences as well as a summary of various research focuses on Alzheimer's disease scientific community is presented. Initially among Alzheimer's disease investigators, the top 100 rankings are arranged to evaluate impact and productivity and its metrics are engaged in an Alzheimer's disease-specific h-index. Many of the authors among them have the same h-index and to differentiate them two derivatives of h-index are suggested: the Second-Tier h-index and the Scientific Following h-index. Membership to the Institute of Medicine of the US and National Academy of Sciences are the winners of the prestigious awards for Alzheimer's disease research are highlighted.

3. SCOPE AND LIMITATIONS OF THE STUDY

The proposed study is confined to Alzheimer's disease based on the literature reported in Elsevier's Scopus database. The main focus of this study will be on research output in terms of publication reflected in the Scopus Database for only 10 years i.e. (2010-19).

4. OBJECTIVES OF THE STUDY

The main objectives of the study are:
- To analyse the growth of Alzheimer's research publications in India.
- To examine the authorship pattern, collaboration coefficient, and collaborative index of authorship pattern of Alzheimer research publications.
- To identify the authors' total citations and h-index.
- To find out the document-wise distribution of publications.
- To identify the most preferred keywords.

5. METHODOLOGY

The scholar has selected the Scopus database since it covers 100% of the Medline database. Hence, the necessary bibliographical records were downloaded from the Scopus database for this study. This study uses the Scopus international database to extract relevant publications data on Alzheimer's research for ten years (2010-19). The following search strategy has been used to retrieve the data i.e.(TITLE-ABS-KEY(""Alzheimer"") AND (LIMIT-TO (PUBSTAGE,""final"")) AND (LIMIT-TO (PUBYEAR,2019) OR

LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011) OR LIMIT-TO (PUBYEAR,2010)) AND (LIMIT-TO (AFFILCOUNTRY,""India"")) AND (LIMIT-TO (LANGUAGE,""English"")))". A total of 3944 records on Alzheimer's research were downloaded and all the bibliographic details have been transferred to a spreadsheet and thus used relevant formulas and tools to evaluate the same.

6. DATA ANALYSIS AND INTERPRETATIONS

6.1 Year-wise distribution of publications and citations of Alzheimer Disease

Table views clearly that during the period 2010-19 a total of 3944 publications were published in India. The highest publication is 620 in 2019, followed by 601 papers in 2018, 507 papers in 2017, 467 papers in 2016, 404 papers in 2015, 370 papers in 2014, 299 papers in 2013, 257 papers in 2012, 237 papers in 2011 and the lowest number of publications in the year 2010 records only 182 publications.

It also calculated the total citations of publications in this table. These papers have together received total citations of 74547 of total publications for the period 2010-19 on Alzheimer's disease. The highest total citation is 12727 (17.07%) in 2012 with first-rank position, followed by the citation 12107 (16.24%) in 2015, 8898 (11.94%) citations in 2018, 8393 (11.26%) citations in 2014, and 6857 (9.20%) citations in 2016 respectively.

Table 1: Year-wise distribution of publications and citations

Year	No. of Publications	Total Citations	Percentage of Citations
2010	182	6495	8.71 %
2011	237	5376	7.21 %
2012	257	12727	17.07 %
2013	299	6305	8.46 %
2014	370	8393	11.26 %
2015	404	12107	16.24 %
2016	467	6857	9.20 %
2017	507	6243	8.37 %
2018	601	8898	11.94 %
2019	620	1146	1.54 %
Total	3944	74547	100.00 %

6.2 Annual Growth Rate and Compound Annual Growth Rate of Publications of Alzheimer   Disease

Annual growth rate (AGR) is defined as a measure of the growth in the publication output of a year relative to the research output of the previous year and it is a useful tool for assessing the yearly trends in research productivity. The formula for finding AGR is as explained as

$$AGR = \frac{publications\,in\,final\,year - publications\,in\,previous\,year}{publications\,in\,previous\,year} \times 100$$

Compound Annual Growth Rate (CAGR) is a geometric progression ratio that provides a constant rate of growth over multiple periods. CAGR is represented in percentage and

calculated by taking the nth root of the total percentage growth rate, where n is the number of years in the period being considered. The formula for CAGR is explained as

$$CAGR=(ending\ value/beginning\ value)^{1/\#\ of\ years}-1$$

To analyze the AGR and CAGR of publications on Alzheimer's disease in India, the data has been presented in the below table.

Table 2: Annual Growth Rate and Compound Annual Growth Rate of Publications of Alzheimer Disease

Year	No. of Publications	Annual Growth Rate (AGR)	Compound Annual Growth Rate (CAGR)
2010	182	0	0
2011	237	30.22	0.14
2012	257	8.44	0.03
2013	299	16.34	0.04
2014	370	23.75	0.04
2015	404	9.19	0.01
2016	467	15.59	0.02
2017	507	8.57	0.01
2018	601	18.54	0.02
2019	620	3.16	0

Table views clearly that during the year 2010-19, a total of 3944 publications were published at India. The highest publication is 620 in 2019 with AGR 3.16 and CAGR 0, followed by 601 papers in 2018 with AGR 18.54 and CAGR 0.02, 507 publications in the year 2017 with AGR 8.57 and CAGR 0.01 and 467 publications in 2016 with AGR 15.59 and CAGR with 0.02. The lowest number of publications in the year 2010 is 182 with AGR and CAGR 0. Further study on genetic disorder publications conducted by Shukla in the year 2019 using the same formula and found that AGR and CAGR was in fluctuating trend same as the particular study.

6.3 Relative Growth Rate and Doubling Time of publications of Alzheimer disease

The relative growth rate is defined as the increase in the number of publications per unit of time. The mean relative growth rate over a specified period of an interval can be calculated from the following equation.

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

Doubling time is calculated when there is similarity existing between the relative growth rates and doubling time. "If the number of publications of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. If one uses natural logarithms, this difference has a value of 0.693". Thus, the corresponding doubling time for publications can be calculated by the following formula:

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

Table 3: Relative Growth Rate and Doubling Time of publications

Year	No. of Publications	Cumulative Sum	W1	W2	RGR	Dt
2010	182	182	0	5.20	0	0
2011	237	419	4.74	6.04	1.29	0.54
2012	257	676	5.67	6.52	0.85	0.82
2013	299	975	6.22	6.88	0.66	1.05
2014	370	1345	6.68	7.20	0.53	1.31
2015	404	1749	7.05	7.47	0.42	1.66
2016	467	2216	7.35	7.70	0.36	1.94
2017	507	2723	7.67	7.91	0.24	2.94
2018	601	3324	7.94	8.11	0.16	4.22
2019	620	3944	8.20	8.28	0.08	8.16

The table presents data on the relative growth rate and doubling time for total research publications in Alzheimer's disease. It could be noted that in 2010, 182 papers have been published in Alzheimer's disease and the number went up to 620 by the year 2019. It is seen that its relative growth rate is 0 in 2010, whereas in the year 2011 it is 1.29 and then the relative growth follows the decreasing trend, and finally in 2019 the growth rate decreased to 0.08. Contrastingly, the doubling time for publication of all sources of Alzheimer's disease research output has increased from 0 in 2010, followed by 0.54 in 2011, 0.82 in 2012, 1.05 in 2013, and finally 8.16 in 2019. Another study on Jaundice literature conducted by Shukla in 2019 was also found the same pattern of RGR and Dt i.e. in decreasing and increasing trend respectively.

6.4 Document Type Distribution of Publications of Alzheimer Disease
The productivity of scientists on Alzheimer's disease spreads over various (eleven types) of publication media, such that journal articles, review, conference paper, book chapters, letters, editorials, notes, short surveys, books, erratum, and data paper. It is clear from the graph that the share of articles is the most prominent bibliographic form of publication and it occupies 2368 of total publications. The source of Review with research publication occupies 997 and it stood in the second position, conference paper with 222 contributions, book chapters with 195 contributions, the letter with 51 contributions, and editorials with 48 followed by remaining bibliographic forms. The remaining document types scored the low numbers of output for communication among Alzheimer's disease scientists.
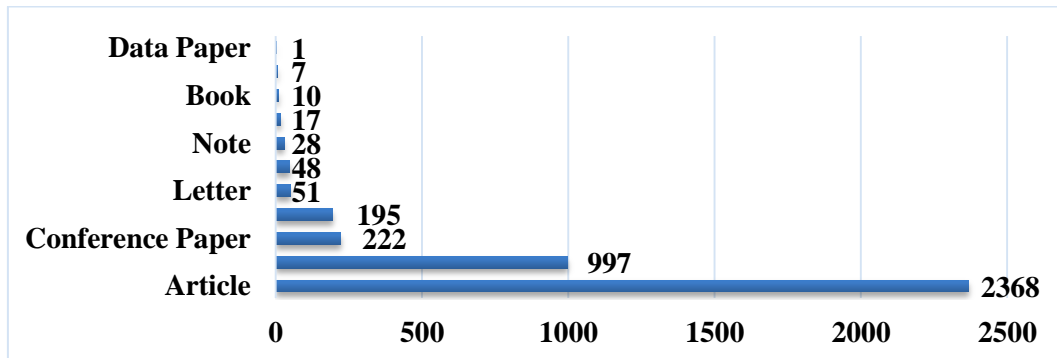

Figure 1: Document Type Distribution of Publications of Alzheimer Disease

6.5 Most productive authors with their affiliations, h- index and total citations

The table shows the top 20 most productive authors with their affiliations, h-index, and total citations of the publications. It also shows that author Kamal, M.A from King Abdulaziz University, Jeddah, Saudi Arabia has got highest 33 h-index against 43 publications, followed by the author Tripathi, M. from All India Institute of Medical Sciences, New Delhi, Department of Neurology, New Delhi, India with 27 h-index against 30 publications and the third one is Khan, R.H. from Aligarh Muslim University, Aligarh, India with 47 h-index against 24 publications. Among the top 20 authors, author Kamal, M.A has included 4883 total citations for its 43 publications which are followed by the author Tripathi, M with 4282 total citations for its 30 publications and the author Khan, R.H. has 8083 total citations for 24 publications.

Table 5: Most productive authors with their affiliations, h- index and total citations

Sl. No.	Author Name	Affiliations	No. of Publications	h-index	Total Citations
1	Kamal, M.A.	King Abdulaziz University, Jeddah, Saudi Arabia	43	33	4883
2	Tripathi, M.	All India Institute of Medical Sciences, New Delhi, Department of Neurology, New Delhi, India	30	27	4282
3	Khan, R.H.	Aligarh Muslim University, Aligarh, India	24	47	8083
4	Singh, N.	Punjabi University, Patiala, India	24	37	5183
5	Ashraf, G.M.	King Abdulaziz University, Jeddah, Saudi Arabia	21	21	1970
6	Chakrabarti, S.	MM Institute of Medical Sciences and Research, India	21	23	1354
7	Maiti, S.	Tata Institute of Fundamental Research, Mumbai, Mumbai, India	21	30	3568
8	Manivasagam, T.	Annamalai University, Chidambaram, India	21	23	1630
9	Ramakrishnan, S.	Indian Institute of Technology Madras, Chennai, India	21	15	741
10	Anand, A.	Postgraduate Institute of Medical Education & Research, Chandigarh, Chandigarh, India	20	20	1977
11	Devi, K.P.	Alagappa University, Karaikudi, India	19	23	2245
12	Dey, S.G.	Indian Association for the Cultivation of Science, Kolkata, India	19	12	563
13	Varghese, M.	National Institute of Mental Health and Neuro Sciences, Bengaluru, India	19	17	1620
14	Bharate, S.B.	Indian Institute of Integrative Medicines (CSIR), Jammu, India	18	29	3168
15	Bharath, S.	National Institute of Mental Health	18	10	278

16	Chopra, K.	and Neuro Sciences, Bengaluru, India			
16	Chopra, K.	University Institute of Pharmaceutical Sciences India, Chandigarh, India	18	52	8088
17	Deshmukh, R.	Maharaja Ranjit Singh Punjab Technical University, Bathinda, Bhatinda, India	18	15	1013
18	Essa, M.M.	Sultan Qaboos University, Muscat, Oman	18	26	2200
19	Alladi, S.	National Institute of Mental Health and Neuro Sciences, Bengaluru, India	17	18	1649
20	Kumar, A.	National Botanical Research Institute India, Lucknow, India	17	33	4295

6.6 Collaboration Coefficient and Collaborative Index of authorship pattern of Alzheimer Disease

The Collaborative Coefficient (CC) value lies between 0 and 1, and is 0 for a collection of purely single-authored papers, it is not 1 for the case where all papers are maximally authored, that is, every publication in the collection has all authors in the collection as co-authors. The formula used for calculating CC is as follows.

$$CC = 1 - \frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}$$

The new measuring technique is almost the same as that of CC, Modified Collaborative Coefficient (MCC) is also given by Ajiferuke in 1988. In this, it is found that if a paper has a single author, the author receives one credit, and if the paper has two authors, each receives 1/2. MCC value also lies between 0 and 1 and 0 to correspond to single authorship.

$$MCC = \left(\frac{N}{N-1}\right)\left\{1 - \frac{\sum_{j=1}^{A}\left(\frac{1}{j}\right)fj}{N}\right\}$$

The collaboration Index is defined by Lawani in 1980. This index gives the mean number of authors per paper. It has no upper limit and cannot express as a percentage. The CI is the simplest index presently used to explore the literature, which is to be interpreted the mean number of authors per paper and the formula is given below:

$$CI = \frac{\sum_{j=1}^{A}jfj}{N}$$

The table below shows the authorship pattern of contributions of papers on Alzheimer's disease. Out of 182 articles in the year 2010, a single author has contributed 18 articles, 43 articles were published with two authors, 46 articles were published by three authors, 32 of the contributions were published by four authors and 43 of the contributions were published by five authors. With an increase in the years the work of the authors goes on

increasing and in 2019 out of total 620 publications, 60 articles were contributed by single authors, followed by 139 articles were contributed by two authors, 123 by three authors, 108 by four authors and more than four authors contributed to 190 articles.

Table 6: Collaboration Coefficient and Collaborative Index of authorship pattern of Alzheimer's Disease

Year	Single Author	Two Authors	Three Authors	Four Authors	More than Four Author	Total	Collaboration Coefficient (CC)	Modified Collaboration Coefficient (MCC)	Collaborative Index (CI)
2010	18	43	46	32	43	182	0.61	0.61	3.21
2011	40	49	43	46	59	237	0.57	0.57	3.15
2012	32	56	54	44	71	257	0.60	0.60	3.26
2013	27	83	57	46	86	299	0.61	0.61	3.27
2014	38	98	77	61	96	370	0.60	0.60	3.21
2015	43	94	85	86	96	404	0.61	0.61	3.24
2016	55	110	77	89	136	467	0.60	0.60	3.30
2017	55	118	78	87	169	507	0.61	0.62	3.39
2018	52	143	126	121	159	601	0.62	0.62	3.32
2019	60	139	123	108	190	620	0.62	0.62	3.37

The CC for the authors of the year 2010 has been calculated and the result is 0.61, whereas for MCC the calculated result is 0.61. It is observed that the overall productivity of Alzheimer's disease by 2019 authors ranks the first position and their CC and MCC have been calculated as 0.62. The highest CC and MCC has been calculated for the years 2018 and 2019 (0.62), followed by 2010, 2013, 2015 and 2017 (0.61), 2012. 2014 and 2016 with (0.60) and the remaining year, that is, 2011 with 0.57. It is observed from the table the Collaborative Index (CI) for the year 2010 is 3.21, followed by the year 2011 is 3.15, 2012 is 3.26 and 3.27 for 2013 respectively. The highest CI is of the year 2017 i.e. 3.39, followed by 2018 (3.32) and the lowest CI is of 2011 (3.15).
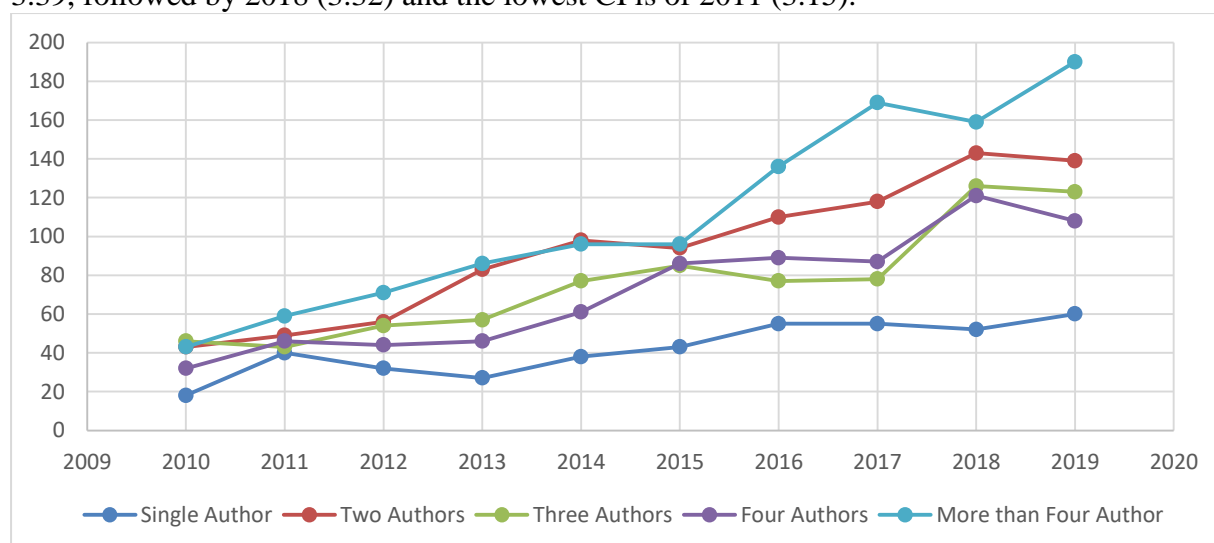

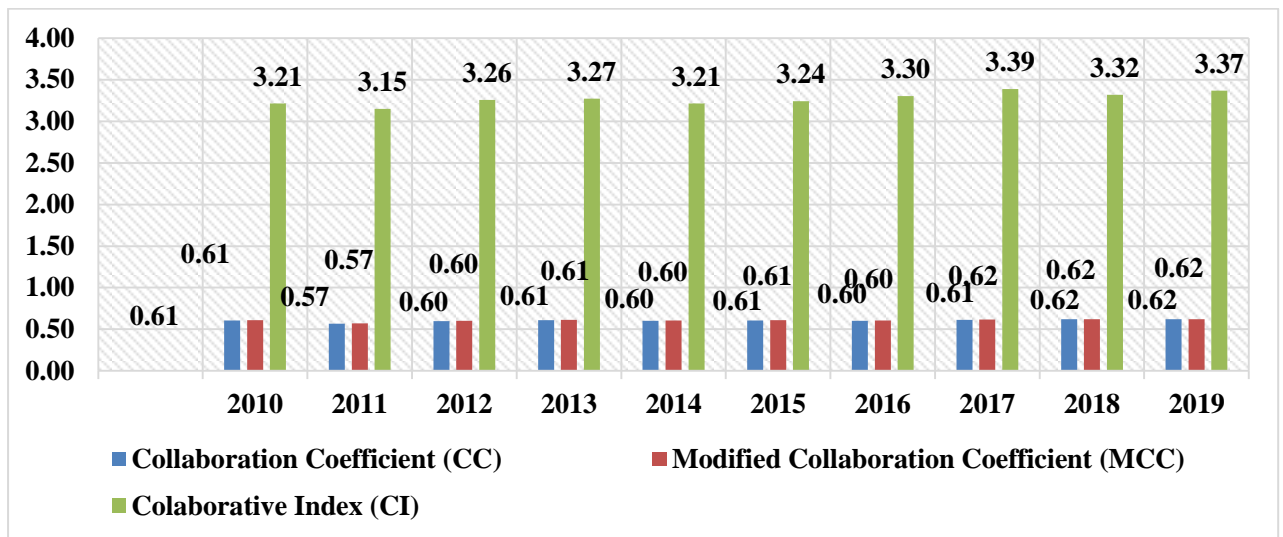**Figure 2(a): Authorship Pattern of Alzheimer Disease**

Figure 2(b): Collaboration Coefficient and Collaborative Index of authorship pattern

6.7 Subject-wise distribution of Publications of Alzheimer Disease

The subject-wise productivity of Alzheimer's disease research during the period under study is given in the graph. The research papers published during the period 2010-2019 are classified broadly into 20 main subjects. The analysis of data could find that a very majority number of multidisciplinary and interdisciplinary areas of research on Alzheimer's disease have been carried out in India. The analysis shows that a majority of the research contribution for the study period is on Biochemistry, Genetics, and Molecular Biology 1382, next is Medicine with 1113 publications, Chemistry with 576, Computer Science with 309 publications and followed by other subjects.
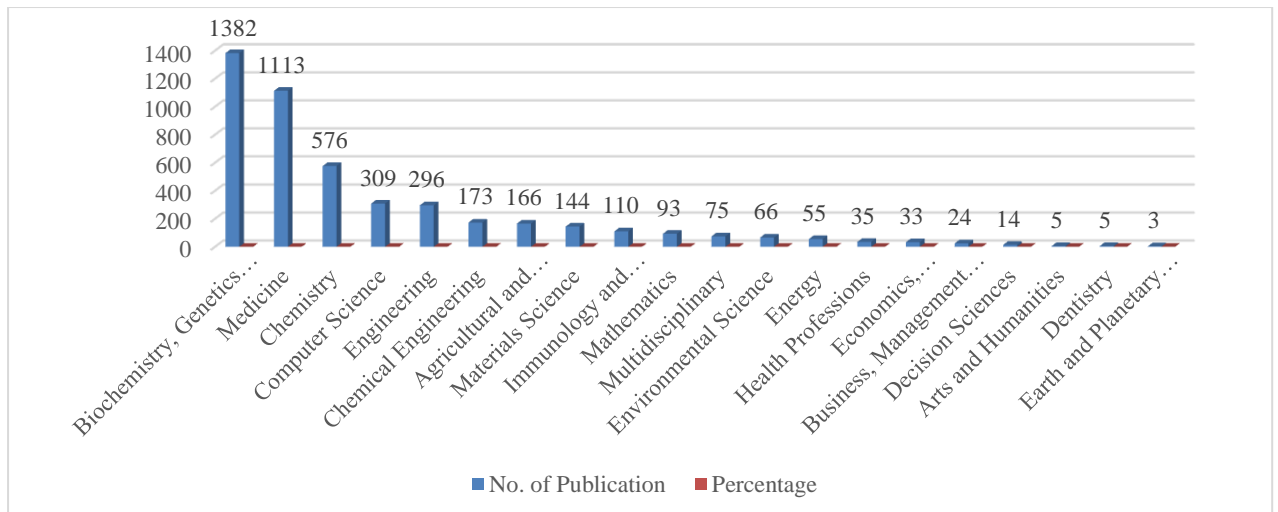

Figure 3: Subject-wise distribution of Publications of Alzheimer Disease

6.8 Most productive affiliations with their publications of Alzheimer Disease

The study of institution wise growth rate in Alzheimer's disease research output is considered to be an important attribute of scientometric analysis. In general, institutions that are explicitly meant for research activities would contribute a greater level of

research publications and it is not up to the mark of the desired level of expectations in other institutions.

Table 8: Most productive affiliations with their publications of Alzheimer Disease

Sl. No.	Affiliation	No. of Publication	Percentage
1	Panjab University	109	8.07%
2	Postgraduate Institute of Medical Education & Research, Chandigarh	98	7.26%
3	National Institute of Mental Health and Neuro Sciences	94	6.96%
4	All India Institute of Medical Sciences, New Delhi	90	6.67%
5	King Abdulaziz University	81	6%
6	Academy of Scientific and Innovative Research AcSIR	78	5.78%
7	Banaras Hindu University	73	5.41%
8	Aligarh Muslim University	72	5.33%
9	Council of Scientific and Industrial Research India	71	5.26%
10	JamiaHamdard	70	5.19%
11	University of Delhi	68	5.04%
12	University Institute of Pharmaceutical Sciences India	63	4.67%
13	Central Drug Research Institute India	54	4%
14	Jawaharlal Nehru University	53	3.93%
15	Manipal Academy of Higher Education	48	3.56%
16	Indian Institute of Chemical Biology	47	3.48%
17	Punjabi University	46	3.41%
18	University of Calcutta	46	3.41%
19	Annamalai University	46	3.41%
20	Alagappa University	43	3.19%

The analysis of the table indicates Institution wise research productivity. It is noted that Panjab University had contributed the highest number of research publications 109 (8.07%) and has Postgraduate Institute of Medical Education & Research, Chandigarh contributed the second-highest number of research publications 98 (7.26%) and National Institute of Mental Health and Neuro Sciences has contributed the third-highest number of research publications with records 94 (6.96%) stands third and others. All India Institute of Medical Sciences, New Delhi ranked at 4th Position with 90 publications and followed by King Abdulaziz University ranked 5th position with 81 publications and so on of the publication output on Alzheimer's disease in India level.

6.9 Preferred sources with their publications of Alzheimer Disease
The figure shows the preferred sources with their publications of Alzheimer's disease. Twenty sources are analyzed with their publications on Alzheimer's disease in India where the following given sources are identified having included articles on Alzheimer's disease with special reference to India.
The analysis shows that the highest number of articles on Alzheimer's disease in India is published in "Journal Of Alzheimer S Disease". It alone contributes to 8.54% of the total publication. CNS And Neurological Disorders Drug Targets stands second having some

publications 7.56%, followed by ACS Chemical Neuroscience with 6.44% of publications and Asian Journal Of Pharmaceutical And Clinical Research stands at fourth position with 6.3% of publications and so on. Neurochemistry International contains the lowest number of 2.94% of publications.
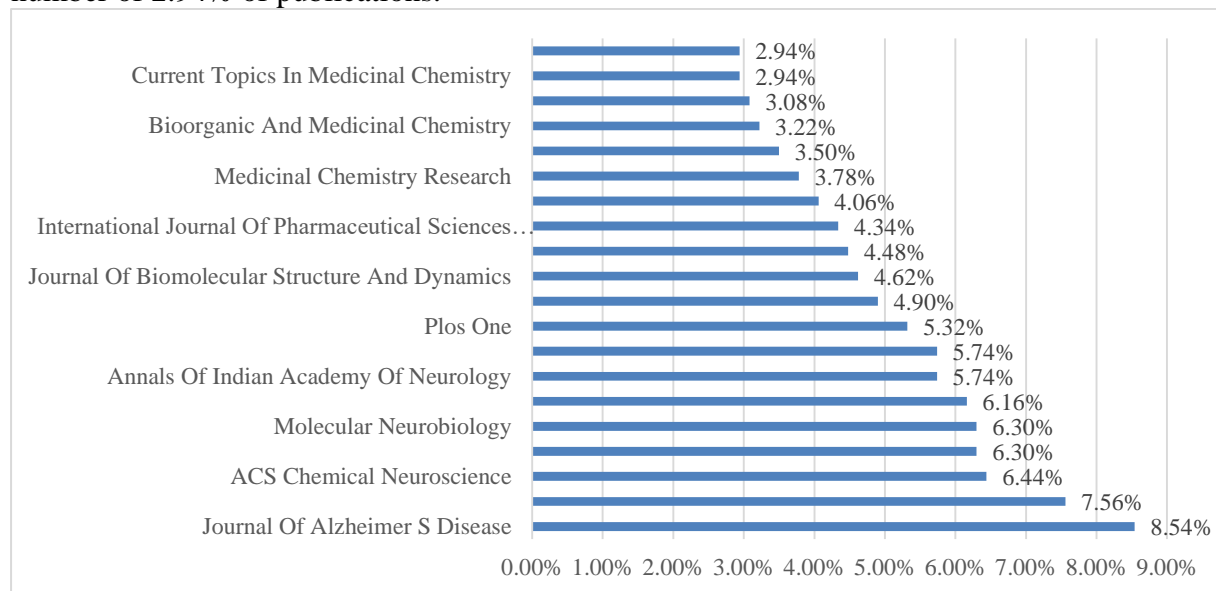

Figure 4: Preferred sources with their publications of Alzheimer Disease

6.10 Funding Agencies with their number of publications of Alzheimer Disease

The figure indicates the top 20 funding agencies with publications. It is found from the analysis that there are large numbers of funding agencies were acknowledged by the research publications on Alzheimer's disease in India. It is revealed that University Grants Commission has the largest number of publication output 219 (17.15%) from this sponsored research, while Department of Science and Technology, Ministry of Science and Technology is at the second position that has sponsored the research for 131 (10.26%) of publications, Indian Council of Medical Research sponsored with 125 (9.79%) publications, Department of Biotechnology, Government of West Bengal sponsored with 108 (8.46%) publications respectively at third and fourth positions among sponsoring agencies.
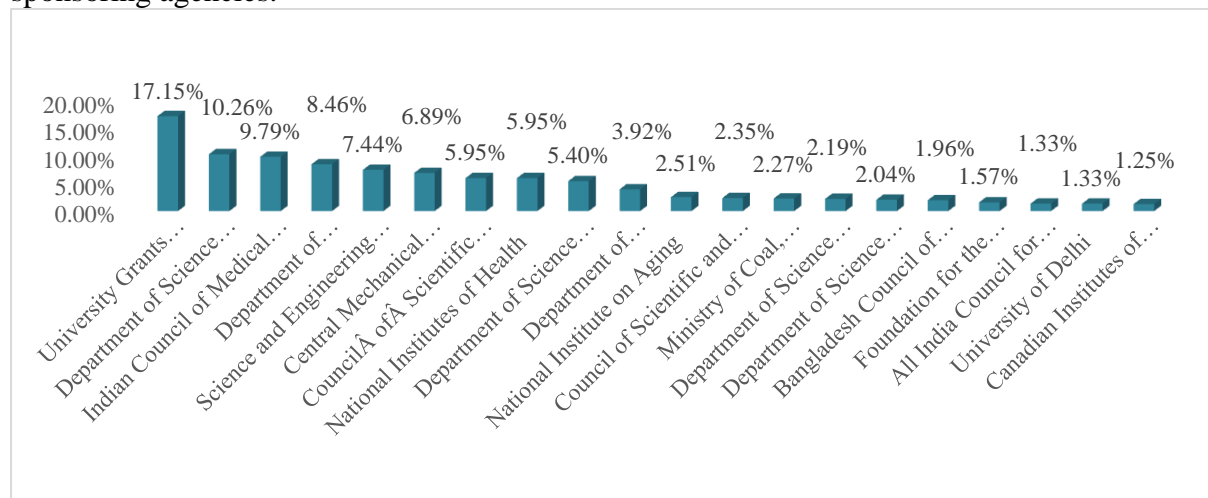

Figure 5: Funding Agencies with their number of publications of Alzheimer Disease

6.11 Top 20 Most productive keywords in Alzheimer Disease Research

In the percentage analysis, Alzheimer's disease (10.97 %) dominates in the first place among these top twenty keywords, followed by a human (9.98%) of publications contributed by the researcher on Alzheimer's disease scientist and it stood in the second rank. The remaining keywords have very low value than Alzheimer's disease and humans. The keywords are articles, nonhuman, Alzheimer's disease, priority journal, controlled study, etc. It could be noted that Alzheimer's disease is the dominant keyword for publication in India production from Alzheimer's disease scientists, followed by humans respectively. The following graph has revealed the most productive keywords in Alzheimer's disease research.
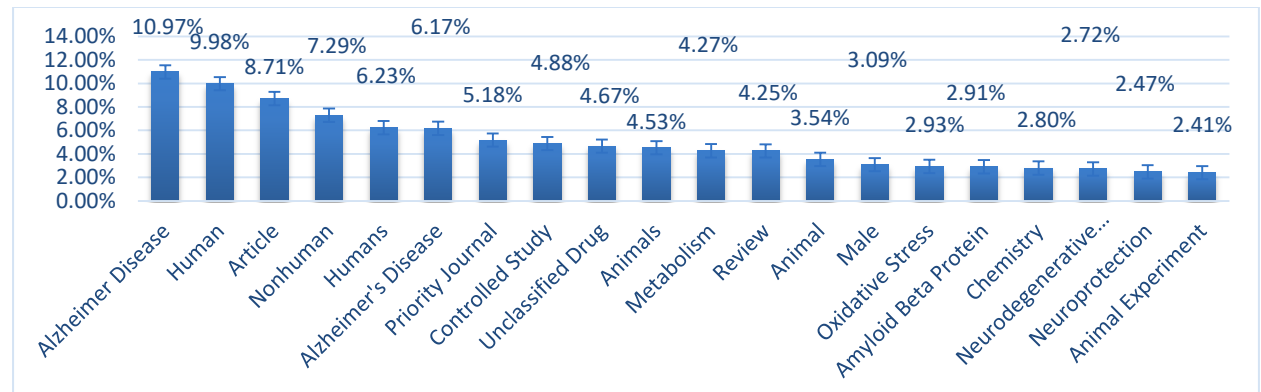

Figure 6: Top 20 Most productive keywords in Alzheimer Disease Research

7. FINDINGS

- The study showed that a total of 3944 publications were published in India. The highest publication is 620 in 2019 with AGR 3.16 and CAGR 0, followed by 601 papers in 2018 with AGR 18.54 and CAGR 0.02. The lowest number of publications in the year 2010 is 182 with AGR and CAGR 0. The overall growth of the publication of Alzheimer's disease research output brings out the research paper published trend in increasing trend.

- The relative growth rate of publication has shown a declined trend; it means that the rate of increase is low in terms of proportion except for 2011 it is increased as 1.29, consequently, the mean doubling time for publication of Alzheimer's disease has shown an increasing trend. This has been highlighted by doubling time for publications which is more than the relative growth rate.

- The findings of document wise distribution of Alzheimer disease research output bring out the facts that of the various sources of Alzheimer disease literature publications, the journal Articles has constituted highest of the total document source, followed by Review and that the highest number of articles on Alzheimer's disease in India is published in "Journal Of Alzheimer S Disease". It alone contributes to 8.54% of the total publications.

- It is observed that the author Kamal, M.A from King Abdulaziz University, Jeddah, Saudi Arabia has got highest 33 h-index against 43 publications, followed by Tripathi, M. from All India Institute of Medical Sciences, New Delhi, Department of Neurology, New Delhi, India with 27 h-index against 30 publications. Among the top 20 authors, author Kamal, M.A has included 4883

total citations for its 43 publications which are followed by the author Tripathi, M with 4282 total citations for its 30 publications.

- The findings of the authorship pattern of research output bring out the fact that the majority of the articles are contributed by multiple authors. Especially more than four authors' contribution is the highest among the other collaborative productivity. It is observed that the overall productivity of Alzheimer's disease by 2019 authors ranks the first position and their CC and MCC have been calculated as 0.62. The highest CC and MCC has been calculated for the years 2018 and 2019 (0.62).

- The study found that the research prevailed among the top 20 subject categories. Biochemistry, Genetics, and Molecular Biology emerge as the topmost subject of research with 29.55% publications, followed by Medicine with 23.8% publications, Chemistry with 12.32% publications based on Scopus based categories.

- The study reveals that Panjab University ranked first in terms of the number of publications, followed by the Postgraduate Institute of Medical Education & Research, Chandigarh, National Institute of Mental Health and Neuro Sciences, All India Institute of Medical Sciences, New Delhi, etc. respectively, while a large number of 219 (17.15%) University Grants Commission has the largest number of publication output from this sponsored research, while Department of Science and Technology, Ministry of Science and Technology is at the second position that has sponsored the research for 131 (10.26%) of publications.

- The study presents that Alzheimer's disease (10.97 %) dominates in the first place among these top twenty keywords, followed by a human (9.98%) of publications contributed by the researcher on Alzheimer's disease scientist and it stood in the second rank.

8. CONCLUSION

The basis of Scientometrics is bibliometrics, that is, the measurement of publications by using statistical and mathematical methods. Scientometrics is a communication process in science that includes socio-cultural characteristics and puts more stress on the quantitative aspects and uses specific methods such as content analysis, co-word analysis, social network analysis, and citation analysis. Alzheimer's disease has become the most disruptive disease of the aging population and has a socio and economic burden which has resulted in major efforts by the scientific groups to develop therapeutic agents to prevent the continuity of the disease. So far, there is no disease curing drugs approved to treat this disease, and still, there is hope as the numbers of treatments are undergoing clinical trials. The researcher suggests for future study of this area that research can be carried out in overall sampling (from 1950 to till date) and data from the different databases with an application of advanced statistical tools, different scientometric tools, techniques, and indicators. It could help in finding out which area is weak and the strength of the growth rate of the research field in Alzheimer's disease.

REFERENCES

- Alzheimer Disease. Retrieved from https://www.healthline.com/health/alzheimers-disease (Accessed on 19/04/2020).

- Alzheimer's Disease Facts and Figures Report. (2019). Retrieved from https://www.alz.org/media/documents/alzheimers-facts-and-figures-2019-r.pdf (Accessed on 19/04/2020)

- Chen, H., Wan, Y., Jiang, S., & Cheng, Y. (2014). Alzheimer's disease research in the future: bibliometric analysis of cholinesterase inhibitors from 1993 to 2012. *Scientometrics, 98*, 1865–1877. doi 10.1007/s11192-013-1132-3. Retrieved from https://pdfs.semanticscholar.org/a348/56486503115a4e6dfd89a6401579e6391e16.pdf?_ga=2.197217199.1429224399.1586966871-839231400.1586966871

- Gupta, B.M. & Bala, A. (2013). Alzheimer's disease research in India: a scientometric analysis of publications output during 2002-11. *Research in Neurology: An International Journal*, *2013*, 11. doi: 10.5171/2013.204542. Retrieved from https://ibimapublishing.com/articles/RNIJ/2013/204542/204542.pdf

- Leydesdorff, L. & Milojevi, S. (2015). Scientometrics. *Elsevier publications*. Retrieved from https://arxiv.org/ftp/arxiv/papers/1208/1208.4566.pdf

- Pozo, A.S., Aldridge, G.M. & Zhang, Q. (2017). Four decades of research in alzheimer's disease (1975–2014): a bibliometric and scientometric analysis. *Journal of Alzheimer's Disease 59* ,763–783. doi: 10.3233/JAD-170184. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/28671119

- Sengupta, N. (1992). Bibliometrics, Infometrics, Scientometrics and Librametrics: An overview. *Libri, 42*(2), 75-98. doi: https://doi.org/10.1515/libr.1992.42.2.75.

- Sorenson, A. A. (2009). Alzheimer's disease research: scientific productivity and impact of the top 100 investigators in the field. *Journal of Alzheimer's Disease*, 451-465. doi: 10.3233/JAD-2009-1046. Retrieved from https://content.iospress.com/download/journal-of-alzheimers-disease/jad01046?id=journal-of-alzheimers-disease%2Fjad01046

- Shukla, R. (2019). Indian research output on genetic disorder publication using the Scopus database: A scientometric study. *Collnet Journal of Scientometrics and Information Management, 13*(1), 91-102. doi: 10.1080/09737766.2018.1550044.

- Shukla, R. (2019) Indian research output on Jaundice literature using Scopus database: A scientometric study (1998-2017). *Journal of Indian Library Association, 55*(3), 29-37.