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## Research Patterns and Citations in the Cancer Research Output of Bharathiar University

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### Abstract

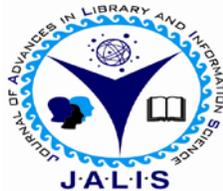
*The paper examines the research pattern and citation in the field of Cancer research done by the researchers of Bharathiar University. The study intended to find out the type of document, the growth in literature, the most prolific authors, and the most relevant sources along with the citations, the most frequent keywords and the degree of collaboration. The researcher collected 428 publications from the Web of Science database. The study found that there is a very high degree of collaboration among the researchers in the field of cancer research and Natarajan K, Padma VV and Kannan S are the most prolific authors. The study concluded that the citations received by the papers reduced over the year so that the researchers should focus on improving the quality of research works based variables such as quality of paper, novelty of ideas, methodology, accessibility and visibility of the research field.*

### Keywords

*Research Pattern, Citation, Cancer Research,  
Bharathiar University, Research Output,  
Scientometric study, Degree of Collaboration*

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## Introduction

Cancer is the second leading cause of mortality worldwide. Overall, the prevalence of cancer has actually increased.<sup>12</sup> India has the largest pool of patients with cancer. For a country like India, preventive oncology and early detection is much more important than drug discovery.<sup>10</sup> Scientific research competence today is important for many professions and activities: it is necessary not only to creatively apply the obtained knowledge but also to create new knowledge, to carry out the applied researches.<sup>7</sup> Quality assurance of higher education-whether based on international evaluation, national evaluation, or international higher education rankings-has defined university professors' research performance as a key indicator because their research and publications relate to their teaching contents as well as to university reputation, funding, and industry linkage.<sup>15</sup> Academic publishing is the process of placing the results of one's research into the literature.<sup>6</sup> The characteristics of academic research is it contains novel ideas and novel information. The defining element of Higher Education Institutions today is research, which has become the gold standard when it comes to evaluation of higher education institutions.<sup>14</sup>

The Bharathiar University was established at Coimbatore by the Government of Tamilnadu in February, 1982 under the provision of the Bharathiar University Act, 1981. The University named after the great national poet Subramania Bharathi is enshrined with the motto "Educate to Elevate".<sup>5</sup> Bharathiar University has been ranked 13<sup>th</sup> among the Indian Universities and 21<sup>st</sup> in the Overall category by NIRF 2020, MHRD, and Government of India. It is one of the 16 universities of the nation have been conferred with special grant under RUSA and majority of the grant is for Cancer research.<sup>4</sup> An analysis of the research output of Bharathiar University will be useful for the authority to get an overview of research progress on cancer research conducting in various departments of the university and to make necessary developmental research planning.

## Review of Related Literature

Ramkumar (2020) portrays the scientometric analysis of Sanskrit Universities in India in terms of the quantum, trend, and overview of the direction of doctoral research, the variance in research productivity between Single- Campus and Multi-Campus University; and the impact of multi-topics

guidance on the research productivity of guides. In a study by Sathi (2019) the research output of faculty members of Indian Institute of Management, Calicut has explained. The findings show that there is a high degree of collaboration among the faculty members and Dr. Kulbhushan Balooni is the most prolific author. A joint author study by Ganesan and Mangai (2019) analyses the Web of science publications of Alagappa University during the period 1989-2016. H-index of Alagappa University is 57. CSIR and South Korea are the most prolific institutions and countries respectively and Sanjeev Raja is the most prolific author. Publication output of Kerala Agriculture University is studied by Ajitha and Vasudevan (2019). Yadav and Others (2020) conducted a scientometric study of Mizoram University based on Indian Citation Index. The multi authorship pattern is dominating in the total of 265 articles of Mizoram University with an average collaboration index of 2.78. A scientometric study of publications of Urumu Dhanalakshmi College is conducted by Jeyachitra and others (2017) found that female faculties contribute very less number of research publications than the male faculties and the most prolific author is Dr. P. Sakthivel. Bhakta and Bhui (2018) commenced a study on the research productivity in University of Petroleum and Energy Studies using scientometrics methods. The importance of the study relies in the ranking of journals according to their citations received by them. The most cited journal is Renewable and Sustainable Energy Reviews with 382 citations, but it ranks fourth according to publication.

The previous studies reviewed here are studying the entire output of a particular institution. None of the studies concentrate on research output of institutions in a particular subject field. So the present study is an attempt to analyze the research publications of Bharathiar University especially in the field of cancer research.

### Methodology

The data collected for the study confined to literature on cancer research of Bharathiar University indexed in the Web of Science database during the period 2010-2020. The retrieved data on cancer research was refined by time span of 2010-2020 and organization enhanced by Bharathiar University. A total of 428 records were downloaded on 9<sup>th</sup> January 2021 and were analyzed based on the objectives framed. Bibliometrix R packages and VOS Viewer were used to scan and visualize the final dataset.

### Objectives

1. To identify the type of document used for communicating cancer research by the researchers of Bharathiar University
2. To find out the growth in literature along with the citation of cancer research output
3. To identify the most prolific authors with citation received by them
4. To find out the degree of collaboration among the researchers
5. To explore the most frequently used keywords in cancer research
6. To list out the most relevant sources with the citation and impact factor

### Results and Discussions

#### Details of data during 2010-2020

**Table 1:** Details of data during 2001-2020

Details	Value
Time span	2010:2020
Documents	428
Authors	1221
Single-authored documents	3
Average citations per documents	15.19
Average citations per year per doc	2.434
References	17317

The data under study contains 428 records which were published during 2010-2020 in the Web of Science database. A total of 1221 authors contributed 428 research publications and among these only 3 are single author contributions. The average citation per document is 15.19 and average citations per year per document. The total number of references is 17317 for all the research publications.

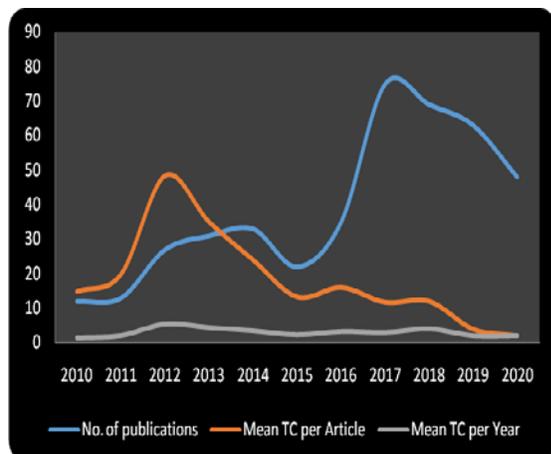
#### Year-wise growth pattern

The year-wise growth pattern with total citations of cancer research output by the researchers of Bharathiar University is given in Table 2 and Figure 1.

**Table 2:** Year-wise growth pattern

Year	No. of records	% of 428	Mean TC per Article	Mean TC per Year
2010	12	2.81	14.833	1.348
2011	13	3.04	19.846	1.985
2012	27	6.31	48.481	5.387
2013	31	7.25	35.032	4.379
2014	33	7.71	23.970	3.424
2015	22	5.14	13.227	2.205
2016	35	8.17	16.029	3.206
2017	75	17.53	11.667	2.917
2018	69	16.13	11.986	3.995
2019	63	14.72	3.869	1.934
2020	48	11.22	1.955	1.955

The growth of publications has escalated from 2010 to 2014. Sudden decline occurs in 2015 with only 22 records. It then dramatically climbed to 75 records in 2017 and it is the peak year of publications. Afterwards a gradual decline occurs from 2017 to 2020. The mean total citation per article shows increment up to 2012 and after 2012 decline over the years. The mean citation per year remains relatively stagnant with three hikes in the years 2012, 2013 and 2018. This shows that citations received by the research output of cancer studies reduced when compared to previous year.



*Figure 1: Year-wise growth pattern*

### Document Type distribution

The means by which the researchers of Bharathiar University communicate their cancer research output

is shown in Table 3. A greater number of research outputs are produced as articles (86.92%) followed by Review (5.84%) and Meeting Abstracts (4.91%). Other types of documents like Proceeding Paper, Letter, Correction and Editorial Material share only less than 1% of the total records. 427 publications are in English language and only one publication is in Welsh language.

**Table 3:** Document Type

Document Types	No. of Publications	% of 428
Article	372	86.92
Review	25	5.84
Meeting Abstract	21	4.91
Proceedings Paper	4	0.93
Letter	3	0.70
Correction	2	0.47
Editorial Material	1	0.23

### Author impact

The impact of author based on the total citation received by the author, h-index and g-index of author is given in Table 4. H-index and g-index is a gauge to measure both the productivity and impact of a particular author based on the citation received by them. Huang CY has the highest number of publications (36 publications) followed by Kannan S and Prabhakaran R with 34 publications each. Natarajan K, Padma VV and Kannan S have the highest number of citations received with comparatively high number of h-index and g-index so they are found the most prolific three authors.

**Table 4:** Author impact

Sl. No.	Authors	No. of Publications	h-index	g-index	TC
1	Huang CY	36	11	16	330
2	Kannan S	34	18	31	1021
3	Prabhakaran R	34	12	26	687
4	Padma VV	32	18	32	1108
5	Natarajan K	28	17	28	1347
6	Viswanadha VP	25	9	14	229
7	Vivek R	21	9	21	578

8	Balachandar V	20	7	10	105
9	Sasikala K	20	7	11	137
10	Paulpandi M	19	9	14	221

**Degree of Collaboration**

In order to find out the degree of collaboration, the formula suggested by Subramanyam<sup>13</sup> has been applied in the study.

The degree of collaboration can be calculated using the formula;

$$DC = N_m / N_m + N_s$$

Where, DC= Degree of Collaboration

$N_m$  = Number of Multiple Authored Paper

$N_s$  = Number of Single Authored Paper

$$\text{Therefore, } DC = 425/425+3 = 0.993$$

It shows that there is a very high degree of collaboration between the researchers in Bharathiar University in the cancer research works.

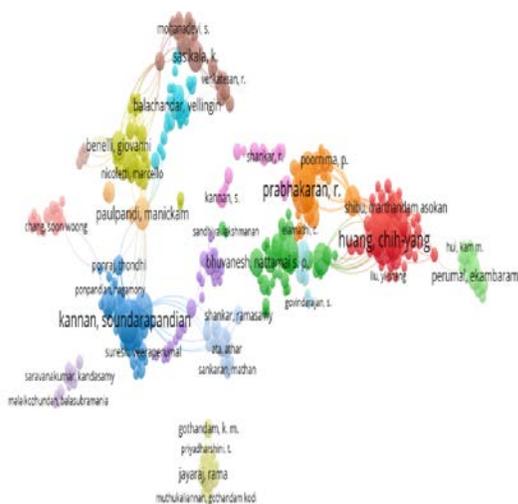


Figure 2: Co-authorship graph

**Most Frequent Keywords**

Analyzing author keywords or keywords plus show the real trend of a research field. Here the most frequently used 20 author keywords are listed in Table 5 and visualize in Figure 4. ‘Cancer’ is the most frequently assigned keyword (n=23) followed by ‘Breast-cancer’ (n=16) and ‘Antibacterial activity’ (n=36). Hence it can be drawn that research works on

breast cancer and antibacterial activity are comparatively more ongoing cancer researches during the study period.

**Table 5:** Most frequent keywords

SL. No.	Keywords	Frequency
1	Cancer	23
2	Breast Cancer	16
3	Antibacterial Activity	11
4	Hepatocellular Carcinoma	9
5	Inflammation	9
6	Neferine	9
7	Anticancer Activity	8
8	DNA Binding	8
9	Oxidative Stress	8
10	Silver Nanoparticles	8
11	Antioxidant Activity	7
12	Protein Binding	7
13	Antibacterial	6
14	Cell Cycle Arrest	6
15	Fisetin	6
16	ROS	6
17	Autophagy	5
18	Chromosomal Aberrations	5
19	DFT	5
20	Meta-Analysis	5

**Trend Topics**

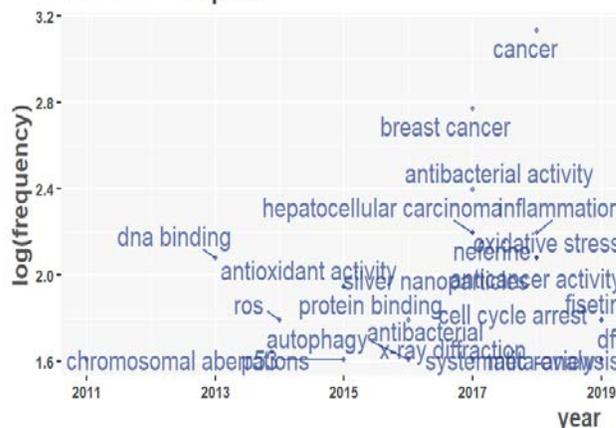


Figure 3: Most frequent keywords

### Most Relevant Sources

The most preferred sources by the researchers in Bharathiar University to publish the cancer research output is given in Table 6 with h-index, g-index, total citation and the impact factor received by the sources.

**Table 6:** with h-index, g-index, total citation

Sl. No.	Sources	Articles	H-Index	G-Index	TC	IF
1	RSC Advances	13	10	13	190	3.119
2	Environmental Toxicology	12	5	8	76	3.118
3	Inorganica Chimica Acta	12	8	12	198	2.304
4	New Journal Of Chemistry	11	7	10	118	3.288
5	Journal of Photochemistry And Photobiology B-Biology	10	7	10	184	4.383
6	Annals of Oncology	9	1	1	1	18.274
7	European Journal of Medicinal Chemistry	9	8	9	310	5.572
8	Journal of Cluster Science	9	5	9	91	1.731
9	Asian Pacific Journal of Cancer Prevention	8	5	8	106	1.583
10	Dalton Transactions	8	7	8	675	4.174

The researchers of Bharathiar University publish their research article in journals with high impact factor. RSC Advances (13 articles, 3.119 IF), Environmental Toxicology (12 articles, 3.118 IF) and Inorganica Chimica Acta (12 articles, 2.304 IF) are the most preferred journals among the total 207 journals.

### Conclusion

Research projects funding based on growth of the research performance of the particular institution. Conducting scientometrics research based on the publication of institutions will be beneficial to the administration as well as the funding agencies. The present study examines 428 publications of

Bharathiar University in the field of cancer research. Among these publication outputs only 3 publications are single authored contributions thus there found a high degree of collaboration of 0.993. The productivity of researchers on cancer research shows gradual decrease after 2017. The mean citation per year remains relatively stagnant with three hikes in the years 2012, 2013 and 2018. Similar to other studies articles are the major document type of publication and only one publication is in Welsh the rest are in English language. RSC Advances, Environmental Toxicology and Inorganica Chimica Acta are the most preferred journals among the total 207 journals. Most of the articles published in the journals which have more than 3 Impact Factor which shows the quality of research works done by the researchers. Natarajan K, Padma VV and Kannan S are the most prolific three authors with the highest number of citations, h-index and g-index. Research works on breast cancer and antibacterial activity are comparatively more ongoing cancer researches during the study period. The citation received by a paper depends on many factors such as quality of paper, novelty of ideas, methodology and accessibility of paper etc. Here it is found that the citations received by the papers are reduced over the year so that the researchers should focus on improving the quality of research works based on these variables.

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