

RESEARCH ARTICLE

BRITISH JOURNAL OF CANCER: A SCIENTOMETRIC STUDY

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ABSTRACT

The present study examined scientific publication research productivity in British journal of cancer for a period of selected 11 years between 2005 and 2015. Making use of various scientometric indicators like the annual growth rate, research document type, author productivity, Degree of collaboration, country wise Distribution, Institution wise distribution was also used to analyze the data and interpretation. The study reveals that total 6818 records were published in the 264 issues of the journal.

Keywords: Authorship Pattern, Bibliometrics Analysis, Cancer, Publication Analysis, Scientometric analysis.

1. INTRODUCTION

British journal of cancer (BJC) has been considered as a source journal for this study. BJC as a quarterly publication in 1947 to 1998, its popularity has led to a doubling in size and a move to fortnightly publication, the first issue of volume 1 and number 1 was published in March 1947 on behalf of Cancer Research UK by Nature Publishing Group, a division of Macmillan Publishers Ltd. Scientometrics analysis has been utilized by many research scholars to investigate conceptual network in different discipline in the most recent couple of decades. For this study, we have picked a couple of them and showed here.

Bharvi Dutta and Khaiser Nikam (1) the present study observed 10905 world publication output in solar cell research for five different years. Xiuwen Chen *et al.* (2) in this paper, a co-word method based on keywords from funded project is proposed to map the research trends. Dhawan *et al.* (3) the paper presents an analytical study of the research output in an e - publishing field in a series of scientometric indicators. As seen from Scopus database the total world output was 7010 publications published in 10 years during 2005-2014. Gnanasekaran and Balamurugan (4) this paper aim to identify the growth of literature on Intellectual Property Rights (IPRs) over a period of 10 years from 2005 to 2014. Ashok Kumar *et al.* (5) the present paper attempts to study the performance of India in RFID research using a series of bibliometric indicators. As seen from SCOPUS database, India's research output cumulated to 632 publications in 10 years during 2006-15. Kalmer Lauk (6) the present paper attempts to study the bibliometrical analysis of research published in oil shale. Palaniappan *et al.* (7) the study examined the

Bibliometric analysis of Indian Journal of Agricultural Research during 2010-2014. Marco Pautasso (8) the present paper attempts to study the Scientometrics of Forest Health and Tree Diseases. Prasad *et al.* (9) this study analyses, research output during 1989-2014 on the Himalayas. Sachithanatham and Raja (10) this study focuses the comparative analysis on the research publications in India and China on the rabies vaccine during 1980-2014. Sangam and Uma Arali (11) this study briefly explain Growth versus scientific collaboration in the field of genetics: A scientometrics analysis. Senthilkumar and Muthukrishnan (12) this study examined the Scientometric Analysis of Research Paper Published on Journal of Thoracic Oncology during 2006-2015.

2. OBJECTIVES

Scientometric methods were used to analysis the research publications published in the British journal of cancer (BJC) during the selected eleven years between 2005 and 2015. The objectives of the present study are

- ✓ To analysis the year wise contribution of research publications during the selected period
- ✓ To determine the annual growth rate (AGR) of articles
- ✓ To examine the authorship pattern of the publications.
- ✓ To find out the author productivity of BJC
- ✓ To determine the Degree of collaboration (DC), and collaborative index (CI) of BJC
- ✓ To find out the country wise distribution of research papers during the selected period

- ✓ To analysis institution wise distribution of research publications.

3. METHODOLOGY

All required data were collected from the “Thomson Reuters - Web of Science” database (WoS) and the search was completed on 10 November 2016 to download all the publications. The literature search was conducted via “Publication Name” search (SO) the term “British journal of cancer” selected in the search field and the timespan 2005-2015 was used as a restriction for the publication data. Finally 6818 publications were selected as the samples and these publications organized the database for further analysis.

The downloaded records were analyzed the standard Scientometric procedure to analysis various parameters like relative growth rate (RGR), doubling time (DT), Authorship Pattern (AP), Degree of collaboration (DI), Time Series Analysis (TA) etc.

4. ANALYSIS OF THE DATA AND INTERPRETATIONS

Year-Wise Distribution of Article Publications

Table 1. Year Wise Distribution of Publications

S No	Year	Volume No.	Total Records	%
1	2005	92-93	593	8.7
2	2006	94-95	594	8.7
3	2007	96-97	579	8.5
4	2008	98-99	688	10.1
5	2009	100-101	631	9.3
6	2010	102-103	536	7.9
7	2011	104-105	593	8.7
8	2012	106-107	609	8.9
9	2013	108-109	778	11.4
10	2014	110-111	684	10
11	2015	112-113	533	7.8
Total			6818	100

Analysis of the data indicates that the annual research output in BJC nearby around 09% of the total output during 2005-2015 are given in Table 1 and Fig. 1 above., the average number of article publication was 619.81 articles per year. According to the findings observed, it could be said that the numbers of research documents published from 2005 to 2015 are considerably closer to each other. It has been observed that the year 2013 has the highest number of publications (11.4%) followed by 2008 (10.1%), 2014 (10%) and 2009 (9.3%) respectively.

The year of 2007 has the lowest publication among the 11 years.

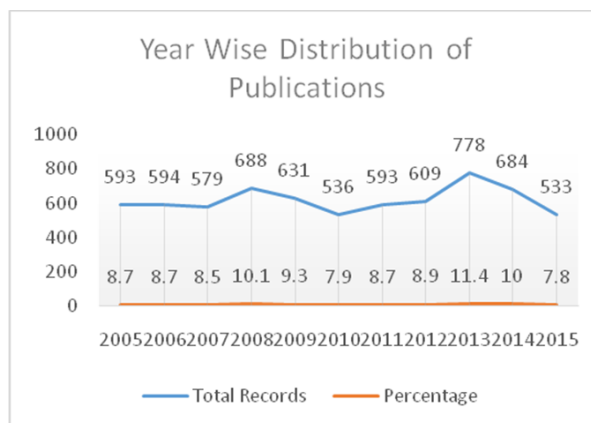


Fig. 1. Year Wise Distribution of Publications

4.1 Relative Growth Rate (Rgr)

The Relative Growth Rate (RGR) is the increase in the number of articles/ pages per unit of time. This definition is derived from the definition of relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany Hunt (1919), Blackman (1919) defined, which in turn had its origin from the study of the rate of interest in the financial investment. The mean Relative Growth rate (R) over the specific period of the interval can be calculated from the following equation.

R

$$1-2 = \text{Loge } 2 W - \text{loge } IW$$

Whereas, 1-2 R = mean relative growth rate over the specific period of interval.

Loge IW = logs of initial number of Articles.

Loge 2 W = logs of the final number of articles over a specific of the period of the interval.

2 T - 1 T = the unit difference between the initial time and final time.

The year can be taken here as the unit of time. The RGR for articles is hereby circulated. Therefore,

1-2 (aa-1 year-1) can represent the mean relative growth rate per unit of the year over a specific period of the interval.

4.2 Doubling Time (Dt)

There exists a direct equivalence between the relative growth rate and the doubling time. If the numbers of articles/pages of subject double during a given period, then the difference the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm

is used, this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula,

$$\text{Doubling time (Dt)} = 0.693/R(p)$$

Therefore, Doubling time for articles $D(t) = 0.693/1-2R$ (aa-1 year-1)

Table 2. Relative growth rate (RGR) and DoublingTime (DT) of publications

S. No	Year	Total Records	%	Cumulative	W1	W2	RGR	DT
1	2005	593	8.7	593	...	6.38
2	2006	594	8.7	1187	6.38	7.07	0.69	1.00
3	2007	579	8.5	1766	7.07	7.47	0.40	1.73
4	2008	688	10.1	2454	7.47	7.80	0.33	2.10
5	2009	631	9.3	3085	7.8	8.03	0.23	3.01
6	2010	536	7.9	3621	8.03	8.19	0.16	4.33
7	2011	593	8.7	4214	8.19	8.34	0.15	4.62
8	2012	609	8.9	4823	8.34	8.48	0.14	4.95
9	2013	778	11.4	5601	8.48	8.63	0.15	4.62
10	2014	684	10	6285	8.63	8.74	0.11	6.30
11	2015	533	7.8	6818	8.74	8.82	0.08	8.66
Total		6818	100	40447				

Table 2 represents RGR and DT for publications for the period 2005-2015, that its relative growth rates has decreased from 2006 (0.69) to 2015 (0.08) in the 11 year period. The Doubling time increased from 1 in 2006 to 8.66 in 2015 and the doubling time is highest in the year 2015 with 8.66. It is clear that the relative growth rate and the doubling time are inversely correlative.

4.3 Authorship Patterns

Table 3 represents that the particulars about the authorship pattern of research articles published during the period of study. A total of 57553 authors has contributed the 6818 articles and the average number of authors per article observed to be 8.44. Among 6818 articles, 193 (2.83%) articles are written by a single author and 6625 (97.17%) articles are written by multiple authors. It could be identified that the Six authored articles involved highest percentage 659 (9.67%), seven authored articles 640 (9.39%) after eight authored articles 630 (9.24%) of the aggregate 6818 articles and nine to seventeen authored contributions are between 8 to 1 percent. The above seventeen authored contributions are below one percent of the articles. In this way, indicating unmistakably the increased pattern towards multiple authorship is dominant as compared to single authorship.

Table 3. Presenting the Authorship pattern of BJC

S. No	No of Authors	No of Publications	%	AP	%
1	Single	193	2.83	193	0.34
2	Two	347	5.09	694	1.21
3	Three	411	6.03	1233	2.14

4	Four	491	7.20	1964	3.41
5	Five	556	8.15	2780	4.83
6	Six	659	9.67	3954	6.87
7	Seven	640	9.39	4480	7.78
8	Eight	630	9.24	5040	8.76
9	Nine	599	8.79	5391	9.37
10	Ten	498	7.30	4980	8.65
11	Eleven	427	6.26	4697	8.16
12	Twelve	316	4.63	3792	6.59
13	Thirteen	259	3.80	3367	5.85
14	Fourteen	185	2.71	2590	4.50
15	Fifteen	132	1.94	1980	3.44
16	Sixteen	120	1.76	1920	3.34
17	Seventeen	75	1.10	1275	2.22
18	Eighteen	54	0.79	972	1.69
19	Nineteen	43	0.63	817	1.42
20	Twenty	44	0.65	880	1.53
21	Twenty+	139	2.04	4554	7.91
Total		6818	100	57553	100

AP = Authorship pattern.

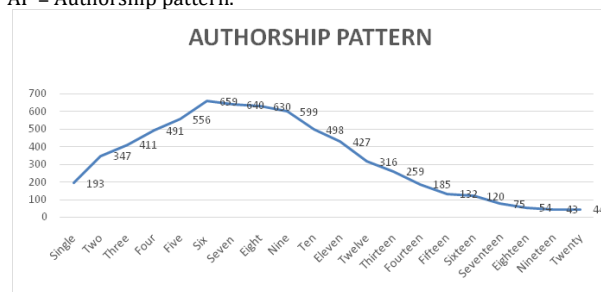


Fig. 2. Presenting the authorship pattern of BJC

4.4 Degree of author's collaboration

Table 4 Fig. 3 represents the degree of collaboration of BJC during the period of study between 2005 and 2015. It was statistically calculated using by the formula given by K Subramanyam, the mathematical deduction of the formula is

$$C = \frac{Nm}{Nm + Ns}$$

Where, C = Degree of collaboration in a discipline

Nm = Number of multi-authored papers in the discipline

Ns = Number of single-authored papers in the discipline

Table 4. Degree of Collaboration of BJC

S	Year	Single	%	Multi	%	D
1	2005-	193	2.83	6625	97.17	

Here, Nm = 6625, Ns = 193,

$$C = \frac{6625}{6625 + 193}$$

= 0.97, Thus, the degree of collaboration (C) is 0.97

The analysis of Table 4 shows that the degree of collaboration during the period of study between 2005 and 2015 is 0.97. The single authored

articles are covered only 193 (2.83%) during the years. The multi authored articles 6625 (97.17%) are maximum throughout the years, which obviously shows its strength upon multi authored collaborative research. However, when we analysis the year-wise degree of collaboration for 11 years, the outcomes arise different and the mean value is 0.97.

Table 5. Year Wise Degree of Collaboration of BJC

S. No.	Year	SAP (Ns)	%	MAP (Nm)	%	Total (Nm+Ns)	%	DC
1	2005	25	12.95	568	8.57	593	8.70	0.96
2	2006	22	11.40	572	8.63	594	8.71	0.96
3	2007	15	7.77	564	8.51	579	8.49	0.97
4	2008	29	15.03	659	9.94	688	10.09	0.96
5	2009	17	8.81	614	9.27	631	9.25	0.97
6	2010	11	5.70	525	7.92	536	7.86	0.98
7	2011	24	12.44	569	8.59	593	8.70	0.96
8	2012	15	7.77	594	8.96	609	8.93	0.98
9	2013	19	9.84	759	11.45	778	11.41	0.98
10	2014	11	5.70	673	10.16	684	10.03	0.98
11	2015	5	2.59	528	8.00	533	7.82	0.99
Total		193	100.00	6625	100.00	6818	100.00	Mean = 0.97

*SAP = Single Authored Paper, *MAP = Multi Authored Papers, *DC = Degree of Collaboration

According to year wise analysis Table, 5 speaks to the year wise number of multi-authored articles and their degree of collaboration. In the study, the degree of collaboration was not a constant value, it reveals the variation of 0.96 to 0.99 and the mean value as 0.97. The analysis found that single author papers continuously reduced every year and the multi-authorship pattern is constantly stable above 7.82%.

4.5 Time series analysis

Table 6. Time Series Analysis of BJC

S. No.	Year	SAP (Y)	X	X ²	XY	MAP (Y)	XY	CP (Y)	XY
1	2005	25	-5	25	-125	568	-2840	593	-2965
2	2006	22	-4	16	-88	572	-2288	594	-2376
3	2007	15	-3	9	-45	564	-1692	579	-1737
4	2008	29	-2	4	-58	659	-1318	688	-1376
5	2009	17	-1	1	-17	614	-614	631	-631
6	2010	11	0	0	0	525	0	536	0
7	2011	24	1	1	24	569	569	593	593
8	2012	15	2	4	30	594	1188	609	1218
9	2013	19	3	9	57	759	2277	778	2334
10	2014	11	4	16	44	673	2692	684	2736
11	2015	5	5	25	25	528	2640	533	2665
Total		193	0	110	-153	6625	614	6818	461

*SAP = Single Authored Paper, *MAP = Multi Authored Papers, *CP = Collaborative Papers

4.5.1 Single authored publications: time series analysis

The straight line equation is applied to arrive at projections for future growth under Time Series analysis. The Straight Line equation $Y_c = a + bX$

since $\Sigma x = 0$, $a = \Sigma Y / N$, $\Sigma Y =$ (Total Number of Paper by Single Author), $N =$ (Number of Years), $a = 193/11$, $a = 17.54$, $b = \Sigma XY / \Sigma X$, $\Sigma XY =$ (Total of XY Tables), $\Sigma X =$ (Total of X² Table), $b = -153/110$, $b = -1.39$.

Estimated literature in 2020 is, When X = 2020-2010(Mid-Year), X = 10, Apply Straight line equation $Y_c = a + bX$ since $\Sigma x = 0$, $Y_c = 17.54 + -1.39 * 10$, $Y_c = 17.54 - 13.9$, $Y_c = 3.64$. The time series analysis found that single author papers continuously reduced every year.

4.5.2 Multi authored publications: time series analysis

Straight Line equation $Y_c = a + bX$ since $\Sigma x = 0$, $a = \Sigma Y / N$, $\Sigma Y =$ (Total Number of Paper by Multi Author), $N =$ (Number of Years), $a = 6625 / 11$, $a = 602.27$, $b = \Sigma XY / \Sigma X$, $\Sigma XY =$ (Total of XY Tables), $\Sigma X =$ (Total of X2 Table), $b = 614 / 110$, $b = 5.58$.

Estimated literature in 2020 is, When X = 2020-2010(Mid-Year) X = 10, Apply Straight line equation, $Y_c = a + bX$ since $\Sigma x = 0$, $Y_c = 602.27 + 5.58 * 10$, $Y_c = 602.27 + 55.8$, $Y_c = 658.07$. The time series analysis also prove the multi-authorship pattern is constantly stable.

4.5.3 Collaborative publications: time series analysis

Straight Line equation $Y_c = a + bX$ since $\Sigma x = 0$, $a = \Sigma Y / N$, $\Sigma Y =$ (Total Number of Paper by Multi Author), $N =$ (Number of Years), $a = 6818 / 11$, $a = 619.81$, $b = \Sigma XY / \Sigma X$, $\Sigma XY =$ (Total of XY Tables), $\Sigma X =$ (Total of X2 Table), $b = 461 / 110$, $b = 4.19$. Estimated literature in 2020 is, When X = 2020-2010(Mid-Year), X = 10, Apply Straight line equation $Y_c = a + bX$ since $\Sigma x = 0$, $Y_c = 619.81 + 4.19 * 10$, $Y_c = 619.81 + 41.9$, $Y_c = 661.71$

On the application of the formula of time series analysis for the expectation of BJC research output for the year 2020, it was found that the future trend and development in BJC research output may take an decreasing trend in single authored publications ($Y_c = 3.64$) during the years to come and collaborative publications trends is constantly stable ($Y_c = 658.07$).

5. CONCLUSION

The findings of the study are summarized as follows.

- ✓ The numbers of research documents published from 2005 to 2015 are considerably closer to each other.
- ✓ It is clear that the relative growth rate and the doubling time are inversely correlative.
- ✓ It could be identified that the six authored articles involved highest percentages 659 (9.67%), in this way, indicating unmistakably the increased pattern towards multiple

authorship is dominant as compared to single authorship.

- ✓ It was found that the future trend and development in BJC research output may take a decreasing trend in single authored publications ($Y_c = 3.64$)

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