

# Research Trends in Diabetes Applying VOS Viewer: A Scientometric Profile

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**C. Catherin Beula**

*Librarian, TDMNS College, T. Kallikulam, Tamil Nadu, India*

 <https://orcid.org/0000-0002-8320-3115>

**Chandran Velmurugan**

*Librarian and Head, Meenakshi Medical College Hospital and Research Institute*

*(MMCH & RI), Enathur, Kanchipuram, Tamil Nadu, India*

### Abstract

*As diabetes is a non-communicable disease, many scientists try to cure it in different ways throughout the globe. Due to the remarkable scientific growth in this area, we focus on evaluating the scholarly publications and their current research trends in diabetes, particularly type 1 diabetes published by Indian scientists using statistical tools and scientometric analysis. A total of 83 318 global research productivity and a total number of research publications from India was 2 381 with 36, 408 global citations and the Period between 2009 and 2018. Further, the total number of authors (17712) and its average number of authors is 7.44, a total number of 782 core journals and 95 228 cited references found during the research period. To evaluate data, various scientometric techniques or indicators were used such as Authorship Pattern (Single vs Multiple), Degree of Collaboration, Relative growth rate (RGR) and Doubling Time (DT) and many more indicators used. This study limits with Indian research output did not include world literature. We try to identify the information in different types of type 1 diabetes between 2009 and 2018. This study will help to find out the core journals for collection management and for promoting diabetes research and developments in future. We chose the core keywords in type 1 diabetes with full records with abstracts, types of manuscripts, cited references using the Web of Science database.*

**Keywords:** Diabetes, Type 1 diabetes, Scientometrics, Mapping technology, VOS viewer, Web of Science, h-index, India.

### Background

Scientometrics cope with measuring scientific publications in all subjects to share information. Price (1971) indicated through "Little Science, Big Science" that science is a measurable substance. Consequently, the workforce engaged in science and science could be evaluated by selected statistical methods. Sarala (2005) pointed out that scientometrics covers all quantitative aspects of science, communication in science and science policy. For the present study, scientometric tools have been applied to measure, monitor, and benchmark the performance, inputs, and outcomes of Type 1 Diabetes publications produced by Indian scientists. These indicators help Type 1 Diabetes to formulate policy, setting priorities, and undertake strategic planning, monitoring, and evaluation.

Diabetes is one of the non-communicable diseases and it is called Madhumeḥ in Hindi. The most celebrated ancient Geek Physician viz "Aretaeus of Cappadocia" coined the term 'Diabetes,' derived from the Greek word 'dia-bangin', the prefix 'dia' denotes 'across or apart', and the word 'bainein' represents 'to walk or stand.' During 250 BC, 'diabetes' was used for the first time by the Greed Apollonius of Memphis. Type 1 diabetes is described as the cruellest disease. This diabetes is caused if the insulin level is low or blood sugar or blood glucose level is too high. Type 1 diabetes (T1D) is also known

as Juvenile or insulin-dependent diabetes. Type 1 diabetes syndrome is connected with genetics and the atmosphere. This disease can direct to loss of function of pancreatic B-cells; it goes through three phases (<https://www.trialnet.org>). In the first phase, it is seen that there is no signs or symptoms, and blood sugar levels remain healthy, although they affect the  $\beta$  cells that produce insulin. In this second phase, we can observe the abnormality caused by the increase in the loss of  $\beta$  cells. But, in the final phase, the immune system changes the blood sugar level due to losing a huge number of  $\beta$  cells. As a result, the symptoms of Type 1 diabetes (T1D) were found to be visible.

### Previous Work

Velmurugan and Radhakrishnan (2015) conducted to recognise the level of the growth pattern of research articles in Pharmacognosy. They found that the highest number of research output was in 2010 and the least number of articles were in 1989. It was also noted that German Cancer Research Centre ranked first and followed by Brazil and India. Gou et al. (2018) studied metabolomics to discover research trends, wise country publications, prolific authors and journals during the period between 1992 and 2017. A total number of 66 721 scientific publications were found in metabolomics with full records and cited references from 1st January 1992 to 16th July 2017. They identified that the most productive 15 countries ranked by the total number of records in metabolomics. They noted that the United States had ranked first with 20 414 research articles, followed by China (7761) and Germany (5689). Goa et al. (2017) carried out a study on diabetes mellitus and T Cells during 1997-2016. A total of 1077 research publications with 28 109 citations were found using the Web of Science database. The results showed that the prolific country was the United States (48.38%) of publications and the most productive year was 2011 (7.89%) while measuring the number of records per year. They investigated that most of the research papers published in the 'Journal of Immunology' and, followed by 'Nature'. Harande (2011) investigated to assess the research growth and mounting the diabetes-related scientific publications in Nigeria. The findings revealed that the publications

growth rate was significantly increased from 1986 onwards on diabetes. He also found that there was enormous progress in terms of teaching and research institutes in the country.

### Need for the Study

In recent days research publications have been part and parcel of academic society. Scholarly scientific articles take part in the most important role in the learned society at the global level. It is noteworthy that the publications of research articles, reports, articles in conference proceedings have radically increased gradually in all the fields. Correspondingly, publishing scholarly papers are a part of research in any field such as Medicine, Engineering, Science and Technology, Social Science in many Universities and Colleges in India. Moreover, it is mandatory for the research scholars to publish their research contents in peer-reviewed journals at national and global levels. Conversely, due to the accelerating cost of periodicals and insufficient economic points of libraries and information centres, the selection and subscription of particular journals for a library should be made vigilantly. Library professionals are forced to reduce the number of journal subscriptions. In this circumstance, Scientometric studies have multi-faceted applications on Library and Information Science in analysing the growth of research to framing subscription policies for the future. This study will help LIS professionals to manage collection development as well as for research scholars to publish their research articles.

### Objectives

The study has been intended with the major purposes are given such as:

1. To find out the growth rate of the most productive year/years of the research papers on diabetes type 1 research in the World and India,
2. To identify the most preferred types of publications like journal articles, article review, conference proceedings, etc.,
3. To observe the most productive countries and most preferred journals on type 1 diabetes, and
4. To identify the productive authors, degree of collaboration in the field of type 1 diabetes.

## Hypotheses

1. The Relative Growth Rate (RGR) demonstrates the decreasing trend and the Doubling Time (DT) reflects an increasing trend in type 1 diabetes research.
2. The Journal articles on type 1 diabetes are predominant than other forms of publications.
3. The collaborative research dominates type 1 diabetes during the study period.

## Material and Methods

The data was collected in Diabetes Type 1 research publications from the bibliographic database of two selected versions such as Science Citation Index (SCI), Science Citation Index – Expanded (SCI-E), which are available in the Web of Science maintained by Clarivate Analytics, formerly Thomas Reuters. The study period between 2009 and 2018 has been chosen for downloading the source data. To search the data, Web of Science Core Collection has been selected and keywords such as “(Diabetes Type 1) OR TOPIC: (Type 1 diabetes) OR TOPIC: (Insulin-dependent diabetes) OR TOPIC: (Juvenile onset diabetes) AND TOPIC: (Juvenile diabetes)”. The downloaded data contains the documents such as articles, reviews, meeting abstracts, letters, editorial materials, articles in proceedings papers, articles in book chapters, articles in data papers, and review in book chapters, correction and retraction. A total of 83 318 global research productivity and a total number of research publications from India was 2 381 with 36, 408 global citations and the Period between 2009 and 2018.

Further, the total number of authors (17712) and its average number of authors is 7.44, a total number of 782 core journals and 95 228 cited references found during the research period. To evaluate data, various scientometric techniques or indicators were used such as Authorship Pattern (Single vs Multiple), Degree of Collaboration, Relative growth rate (RGR) and Doubling Time (DT) and many more indicators used. Moreover, computer free software such as HistCite and VOSviewer has been applied to retrieve and visualise the data and interpretation.

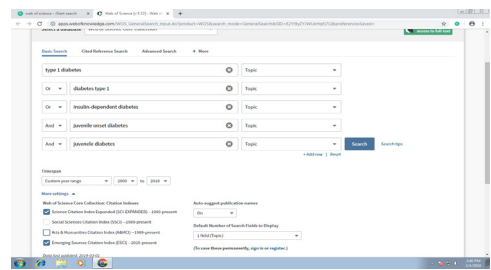


Figure 1: Mapping of Keywords Search on type 1 diabetes

Year	Citations	References
2009	12	1
2010	15	2
2011	18	3
2012	22	4
2013	28	5
2014	35	6
2015	42	7
2016	50	8
2017	60	9
2018	75	10

Figure 2: Mapping of HistCite Image of type 1 diabetes during 2009-2018

## Bibliometric Indicators used for Analysis

Citation per paper or article or ACPP is an average citation per paper or articles used by Zhi Lei and Yuh-Shan Ho (2008) to compute the impact of literature output of years, countries, institutes and authors and keywords. The formula of CPP or ACPP is expressed as a total number of citations for a discipline or country or institution divided by a total number of articles. In contrast, the Relative Citation Impact (RCI) technique is applied to evaluate the influence and visibility of a country’s research at a global perspective. For this method, the formula is expressed as  $RCI = \frac{\text{Percentage of total citations in a particular year}}{\text{Percentage of total publications in a particular year}}$ . Therefore, ACPP and RCI have been applied for a consequential comparison of the impact of the scholarly publications for productive countries, fruitful institutions and prolific authors. These two indicators have been extensively used in bibliometrics and scientometric research to normalise the large disparity in published literature among disciplines, countries and institutions to identify the significant relationship of research impact (Dwivedi et al., 2015, 2017).

**Results**

**Share of Publications**

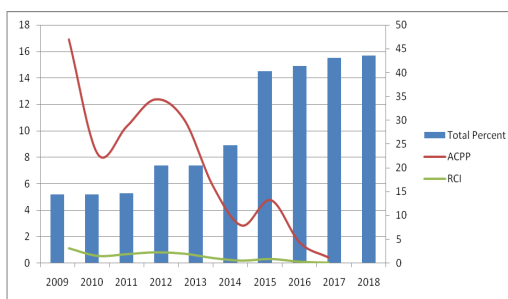
Table 1 describes citation per paper and the relative citation impact of Type 1 diabetes in India. The average citation per paper is calculated by the total number of citations divided by the number of articles. The relative citation impact is measured through the percentage of total citations in a particular year divided by the percentage of total publications in a particular year. Based on the records, the massive number of ACPP was 46.93 in 2009, and the smallest number of ACPP was 1.11 in 2018. The growth of ACPP is calculated based

on global citations. Accordingly, if the citation level is reduced, its impact will be on the ACPP's. In this investigation, the ACPP shows a fluctuating trend, whereas the relative citation impact shows the highest number of RCI, 3.09 in 2009, whereas the smallest amount of RCI was 0.07 in 2018. The RCI value calculated as 1 is normal, the value greater than 1 is above normal, and the value less than 1 is below normal. Therefore, from table 0.0, it is identified that the years 2009 and 2012 have above normal RCI with 3.09 and 2.24 respectively and followed by the years 2010, 2011, 2013, and 2014 have normal RCI and years 2015 to 2018 have below normal RCI.

**Table 1: Analysis of Growth Rate, Citation per Paper and Relative Citation Impact**

S. No	Total Year	TNP	TNP%	TGCS*	Total Percent	ACPP*	RCI*
1	2009	125	5.2	5866	16.11	46.93	3.09
2	2010	125	5.2	2857	7.85	22.86	1.50
3	2011	126	5.3	3605	9.90	28.61	1.86
4	2012	176	7.4	6044	16.60	34.34	2.24
5	2013	176	7.4	5289	14.53	30.05	1.96
6	2014	211	8.9	3389	9.31	16.06	1.05
7	2015	346	14.5	2710	7.44	7.83	0.51
8	2016	354	14.9	4668	12.82	13.18	0.86
9	2017	367	15.5	1561	4.29	4.25	0.28
10	2018	375	15.7	419	1.15	1.11	0.07
<b>Total</b>		<b>2381</b>	<b>100</b>	<b>36408</b>	<b>100</b>		

\*TNP- Total number of publications, \*TGCS- Total Global Citations, ACPP- Average Citation per Paper (ACPP), RCI- Relative Citation Impact



**Figure 3. Analysis of Citation per Paper and Relative Citation Impact**

**Relative Growth Rate (RGR)**

The relative growth rate is an increase in several research papers or pages per unit of time. This scientometric indicator is one of the relevant tools

in library and information science which was created by Garg and Pathi in 1999 to evaluate scientific publications in a given field and the same has been applied in type 1 diabetes. The mean relative growth rate () over the specific period of the interval can be evaluated from the below equation.

The relative growth rate formula is expressed as:  
 $1-2R - \text{Log } W2 - \text{Log } W1 / T2 - T1$

Where,

1-2R represents the mean relative growth rate over the specific period of interval

Loge W1 – indicates the natural log of the initial number of articles.

Loge W2 – indicates the natural log of the final number of articles after a specific period of interval.

T2-T1 = the unit deviation between the initial time and the final time

Therefore, the year can be taken as a unit of time and the relative growth rate has been computed as: (aa-1 year-1) determine that the mean relative growth rate per unit of articles and unit of the year over a specific period of interval.

$$= \text{Loge } W2 - \text{Loge } W1/T2-T1$$

$$2010 \rightarrow = \text{Loge } 250 - \text{Loge } 125/2010-2009$$

$$= 5.52 - 4.83 = 0.69$$

$$2011 \rightarrow = \text{Loge } 376 - \text{Loge } 126/2011-2010$$

$$= 5.52 - 4.84 = 0.639$$

**Table 2: Relative Growth Rate (RGR) AND Doubling Time (DT)**

S. No	Year	Records	Percentage %	Cumulative Records	W1	W2	a1-y2	DT
1	2009	125	5.2	-	4.83	-	-	-
2	2010	125	5.2	250	4.83	5.52	0.69	1.00
3	2011	126	5.3	376	4.84	5.93	1.09	0.636
4	2012	176	7.4	552	5.17	6.31	1.14	0.607
5	2013	176	7.4	728	5.17	6.59	1.42	0.488
6	2014	211	8.9	939	5.35	6.84	1.49	0.465
7	2015	346	14.5	1285	5.84	7.16	1.32	0.525
8	2016	354	14.9	1639	5.86	7.40	1.54	0.450
9	2017	367	15.5	2006	5.90	7.60	1.70	0.407
10	2018	375	15.7	2381	5.92	7.78	1.86	0.372
<b>Total</b>		<b>2381</b>	<b>100</b>					

Above table 2 depicts the RGR and the Doubling Time (DT) for the total records of Type 1 diabetes at the National level. It was found the output of 125 research papers in 2009, and it was increased gradually to 375 in 2018. The growth rate of publications on type 1 diabetes was from 0.69 in 2010 to 1.86 in 2018. The year-wise growth shows from 2010 to 2014 is as gradually increased and after that it is seen the fluctuation trend. The highest value indicates in the year 2018 and the lowest value represents 2010. It is also measured the average relative growth rate of scholarly articles on Type 1 diabetes was 1.361.

### The Doubling Time (DT)

The Doubling Time (DT) for Type 1 diabetes scientific publications is also measured nationally. It finds that the range was from 1.00 in 2010 to 0.372 in 2018, and its average value of doubling time is 0.544 and shows the declining trend. The results reflect that the relative growth rate has seen an increasing trend in literature output while the doubling time has also decreased in Type 1 diabetes research. Thus, the hypothesis, ‘‘The Relative Growth Rate (RGR),

shows the increasing trend, and the Doubling Time (DT) illustrates a decreasing trend in Type 1 diabetes research’’ is proved significantly.

### Medium of Scholarly Publications

Medium of scholarly Publications on type 1 diabetes has been calculated and found a total number of 11 items of manuscripts such as articles, reviews, meeting abstracts, letters, editorial materials, articles in proceedings papers, articles in book chapters, articles in data papers, and review in book chapters, correction and retraction. Out of 2381 publications, a huge number of 2057 publications were articles with 30213 global citations and its h-index is 64. Reviews had in the second position among 11 items with 210 records along with 5154 citations and its h-index is 32 and followed by meeting abstracts had 60 papers with 1 h-index. It is noted that the below 10 number of manuscripts were 6-11. The results show that researchers have more in publishing papers on original articles and reviews. Hypothesis two indicates that ‘‘The Journal articles of type 1 diabetes are predominant than other forms of publications’’ is proved.

**Table 3: Medium of Scholarly Publications**

S. No	Medium Type	TNP	TNP%	TGCS	*CPP	h-index
1	Articles	2057	86.4	30213	14.69	64
2	Reviews	210	8.8	5154	24.54	32
3	Meeting Abstracts	60	2.5	1	0.02	1
4	Letters	17	0.7	16	0.94	2
5	Editorial Materials	16	0.7	81	5.06	5
6	Article; Proceedings Papers	8	0.3	865	108.13	4
7	Article; Book Chapters	6	0.3	55	9.17	4
8	Article; Data Papers	3	0.1	7	2.33	2
9	Review; Book Chapters	2	0.1	11	5.50	1
10	Correction	1	0.0	0	0.00	0
11	Retraction	1	0.0	5	5.00	1
<b>Total</b>		<b>2381</b>	<b>100</b>	<b>36408</b>		

\*CPP- Citation per paper

**Collaborative research by Institution (Top 10)**

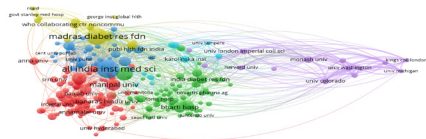
Type 1 diabetes of Indian scientists collaborated with 4657 institutions involved in this research and out of which top 10 institutions has been chosen with more than thirty records. In this context, “All India Inst Medical Science” had ranked first with 113 records and 3870 global citations and its average

citation per paper is 34.25 and its h-index is 24. The next productive institution is “Madras Diabetic Research Foundation” from Chennai with 92 papers. Its h-index is 23 and followed by “Postgrad Inst Medical Education & Research” from Chandigarh with 2100 citations through 59 publications and had occupied the third rank among them.

**Table 4: Collaborative Research by Institution (Top 10)**

Name of the Institution	Location	TNP	TNC	ACPP*	H-Index
All India Inst Medical Science	New Delhi	113	3870	34.25	24
Madras Diabetic Research Foundation	Chennai	92	4123	44.82	23
Postgrad Inst Med Educ & Research	Chandrarh	59	2100	35.59	17
Manipal University	Manipal	47	327	6.96	10
CSIR	Delhi	45	620	13.78	15
Dr Mohans Diabet Special Center	Tamilnadu	35	1978	56.51	16
Banaras Hindu University	Utter Pradesh	33	2566	77.76	11
Christian Medical College & Hospital	Chennai	33	2640	80.00	12
Govt Medical College	Chennai	32	127	3.97	5
Novo Nordisk AS	Denmark	32	1988	62.13	15

\*ACPP- Average citation per paper



**Figure 4: Mapping of Productive Institutions**

**Collaborative Countries Productivity**

Countries collaboration is one of the effective indicators in scientometrics for evaluation. Here, we have found 114 countries collaborating, including India. It is found that 113 countries collaborated with India to share their views and research output. In this context, United States had collaborated very closely and 343 articles were published with 15519

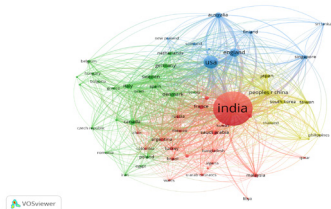
global citations. The United Kingdom had placed second with 154 research output along with 11073 global citations. The third productive country is China, with 78 literature and its global citations are 9087. It is noted from the study of Velmurugan and

Ramasamy (2021) through Nephrology Publications and found the United States had got strength with 869 articles and followed by Italy had 217 papers as it strengthens the research in India.

**Table 5: Country-wise Distribution (Top 10)**

S. No	Country	Records	Percent	TLCS	TGCS
1	India	2377	54.25	1159	36316
2	USA	343	7.71	286	15519
3	UK	154	3.45	153	11073
4	Peoples R China	78	1.76	144	9087
5	Australia	71	1.56	71	6795
6	Canada	64	1.41	51	6825
7	Germany	56	1.23	64	6838
8	Saudi Arabia	54	1.22	22	2882
9	Denmark	53	1.21	59	6124
10	Italy	51	1.14	54	7761

Moreover, Germany (56, 1.23%), Saudi Arabia (54, 1.22%), Denmark (53, 1.21%) and Italy (51, 1.14%) had below 60 publications among the top ten countries in type 1 diabetes literature. It seems to us that there is less involvement and interest in publishing work during the study period.



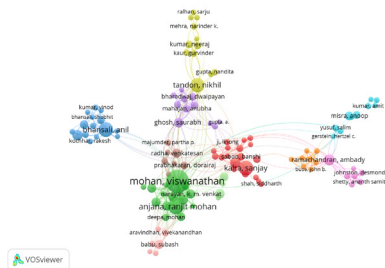
**Figure 5: Mapping of Productive Countries**

**Most Productive Authors (Top 10)**

Authors play a vital role in any research and publishing research papers is essential. For this research, the author’s contribution in the field of type 1 diabetes has been measured. Here, 11199 authors participated and produced research articles on type 1 diabetes in the Indian scenario. Out of which, top prolific authors have been chosen for current analysis and found that the author “Mohan, V” has received 3629 citations with 122 research output and had placed the first and followed by “Anjana RM” had produced 55 research papers with 726 citations and ranked the second place. Tandon N occupied the third rank with 51 articles and the total citations were 2098.

**Table 6: Most productive authors (top 10)**

S. No	Author	Records	TLCS	TGCS
1	Mohan V	122	181	3629
2	Anjana RM	55	80	726
3	Tandon N	51	60	2098
4	Bhansali A	48	57	851
5	Ghosh S	45	54	588
6	Kalra S	44	16	384
7	Kumar A	43	22	694
8	Ramachandran A	35	61	2357
9	Kumar S	33	8	258
10	Gupta A	31	11	296



**Figure 6: Mapping of Productive Authors**

**Degree of Collaboration and Collaborative Index**

Collaborative research is one of the essential factors in the field of scientometrics in any subject. Collaboration occurs when two or more researchers or scientists work together on a particular project and contribute endeavours both physically and

intellectually. In this context, some collaborative research work has already been carried out by the author on Library Herald by Velmurugan and Radhakrishnan (2015), Biotechnology (2015), Information Literacy (2015), Engineering Journal (2015), Journal of Intellectual Property rights by Velmurugan (2013, 2014), Supply Chain Management (2015), Annals of Library and Information Studies by Velmurugan (2013) Indian Journal of Pure and Applied Physics and Technical Review-Journal by Velmurugan (2014).

To know the strength of collaborative research work in this study, we have chosen two scientometric indicators such as degree of collaboration (DC) suggested by Subramaniam, K (1983) and collaborative index (CI), stated by Lawani in 1980.

**Table 7: Degree of Collaboration**

Years	TP	TA	TSA	TMA	DC	CI
2009	125	725	2	723	0.9972	5.8
2010	125	727	4	723	0.9944	5.82
2011	126	941	2	939	0.9978	7.47
2012	176	1043	3	1040	0.9971	5.93
2013	176	2010	4	2006	0.9980	11.42
2014	211	1206	7	1199	0.9941	5.72
2015	346	1871	11	1860	0.9941	5.41
2016	354	3626	13	3613	0.9964	10.24
2017	367	3152	6	3146	0.9980	8.58
2018	125	2411	5	2406	0.9979	19.28
<b>Total</b>	<b>2381</b>	<b>17712</b>	<b>57</b>	<b>17655</b>	<b>0.9967</b>	<b>7.44</b>
<b>Percentage (%)</b>		<b>100</b>	<b>0.32</b>	<b>99.67</b>		

TP- Total No of Papers, TA- Total No of Authors, TSA- Total No of Single Authors, TMA- Total No of Multi-Authors

Degree of Collaboration (DC) was suggested by Subramaniam (K) has been applied as given below.

The formula is expressed as; C= Degree of Collaboration Nm = Number of multiple authors Ns = Number of single authors	C =	$C = \frac{N_m}{N_m + N_s}$
	C =	18032 17655 + 57 = 17712
In the present study, the value of C is	C =	0.9967

The productive authors are presented in the above table 7, year-wise to determine the degree of collaboration. It is found from the table that

the range of the degree of collaboration is from 0.9941 to 0.9980. It is also found that the average degree of collaboration is 0.9967 in Type 1 diabetes



publications during the study period. This analysis brings out the frequency of teamwork that shows the highly collaborative trends in this research. Thus, hypothesis three illustrates that “The collaborative research dominates in diabetes type 1 during study period,” is proved and accepted.

### Identification of Preferred Journals

As we know well aware that the Journal is the backbone of research publications and it is the right mode of communication for information at

the global level. In this context, only the top ten journals are represented in the above table. It is noted that JEMDS had placed first with 495 research publications. “International Journal of Diabetes in Developing Countries” is another productive journal that published 77 records with 231 citations and its h-index is 24. The third rank goes to “Journal of Clinical and Diagnostic Research”, with 64 record counts and 115 global citations, 115 and its h-index is 35.

**Table 8: Preferred Journals in Type 1 Diabetes for Publications**

S.No	Journal	Records	Citations	Country	h-index
1	Journal of Evolution of Medical and Dental Sciences	101	10	India	
2	International Journal of Diabetes in Developing Countries	77	231	India	24
3	Journal of Clinical and Diagnostic Research	64	115	India	35
4	Plos One	61	1264	USA	300
5	Diabetes Research and Clinical Practice	47	731	Ireland	107
6	Diabetes Technology & Therapeutics	41	488	USA	84
7	Indian Journal of Medical Research	33	281	India	81
8	Diabetes & Metabolic Syndrome-Clinical Research & Reviews	29	85	Netherlands	29
9	Diabetes Obesity & Metabolism	28	878	UK	121
10	Journal of Diabetes and its Complications	28	390	Netherlands	82

But, analysing using citations and h-index, “PLOS One” from the United States ranked the first with 1264 citations through 61 literature output and its h-index is 300, and followed by “Diabetes Obesity & Metabolism” from the United Kingdom had ranked with 878 citations through 28 publications and its h-index is 121. The third predominant journal was “Diabetes Research and Clinical Practice” from Ireland with 731 citations and its h-index is 107.

### Conclusion

Publication analysis is one of the metric studies that is very popular in Library and Information Science research. In this research, type 1 diabetes publications have been chosen for analysis to identify the level of growth and research trends in this area. Therefore, a total number of 83 318 global research productivity and a total number of research publications from India was 2 381 with 36,

408 global citations and the Period between 2009 and 2018. The findings of the study focused on various dimensions and the results reveal that it was measured the average citation per paper and found the massive number of ACPP was 46.93 in 2009, and the smallest number of ACPP was 1.11 in 2018. The ACPP shows a fluctuating trend, whereas the relative citation impact shows the highest number of RCI, a 3.09 in 2009, whereas the smallest amount of RCI is 0.07 in 2018. Relative growth rate and doubling time was evaluated and the results reflect that the relative growth rate has seen an increasing trend while the doubling time has shown a decreasing trend in Type 1 diabetes research. Out of 2381 publications, a huge number of 2057 publications were articles with 30213 global citations and its h-index is 64. It was identified the “All India Inst Medical Science” had ranked first among the top ten institutions with 113 research output and 3870 global citations and its average

citation per paper is 34.25 and its h-index is 24. It shows that the United States had collaborated with India very closely and 343 articles were published with 15519 global citations. It was examined the author productivity and found "Mohan, V" received 3629 citations with 122 research output and had placed the first. It was examined the range of the degree of collaboration is from 0.9941 to 0.9980. It is also found that the average degree of collaboration is 0.9967 in Type 1 diabetes publications. Journal of Evolution of Medical and Dental Sciences (JEMDS) had placed the first in terms of research publications (495). But, counting through citations and h-index, "PLOS One" from the United States ranked the first with 1264 citations through 61 literature output and its h-index is 300 during the period of study.

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#### Author Details

**Dr. C. Catherin Beula**, Librarian, TDMNS College, T. Kallikulam, Tamil Nadu, India.

**Email ID:** [beulah.catherin@gmail.com](mailto:beulah.catherin@gmail.com).

**Dr. Chandran Velmurugan**, Librarian and Head, Meenakshi Medical College Hospital and Research Institute, (MMCH & RI), Enathur, Kanchipuram, Tamil Nadu, India, **Email ID:** [murugan73@gmail.com](mailto:murugan73@gmail.com).