Diabetes Research in India, China and Brazil: A Comparative Quantitative Study, 2000-09

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Abstract

The study analysis the diabetic research output during 2000-2009 in global context on several parameters including most productive countries of the world in diabetic research, their rank, publication share, global burden of the disease on respective countries and diabetic research output in relation to their population. In depth, this study evaluate the diabetic research profile of India, China and Brazil including their total publications, citation impact, publications growth, international collaboration share, research priorities under various subjects, diabetic complications and type of diabetes. It also analyses the characteristics of most productive institutions of these three countries.

Keywords

Diabetes Research, Quantitative Study, Research Outpu

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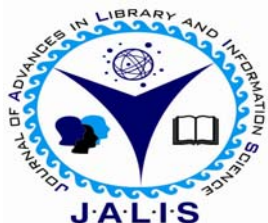
1. Introduction

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Diabetes is a life-threatening condition affecting millions of people. Diabetes is a major threat to global public health that is rapidly getting worse, and the biggest impact is on adults of working age in developing countries. Diabetes is a common condition and its frequency is dramatically rising all over the world. Although diabetes is sometimes considered a condition of developed nations, the loss of life from premature death among persons with diabetes is greatest in developing countries[1].

According to International Diabetic Federation (IDF), the low- and middle-income countries face the greatest burden of diabetes. It is one of the major causes of premature illness and death in most countries. It is estimated that around 330,000 deaths will be attributable to diabetes in 2010 and shows a 5.5% increase over the estimates for the year 2007[2]. Diabetes imposes a large economic burden on the individual, national healthcare system and economy. Healthcare expenditures on diabetes are expected to account for 11.6% of the total healthcare expenditure in the world in 2010. As per IDF estimates, healthcare expenditures to treat and prevent diabetes and its complications are expected to total at least US Dollar 376 billion in 2010. By 2030, this number is projected to exceed some USD490 billion[2].

In 1985, the best data available suggested that 30 million people had diabetes worldwide. Fast-forward 15 years and the numbers were revised to just over 150 million. Today, less than 10 years on, the new figures – launched at the 20th World Diabetes Congress in Montreal, Canada – put the number closer to 300 million, with more than half aged between 20 and 60. IDF predicts that, if the current rate of growth continues unchecked, the total number will exceed 435 million in 2030 – many more people than the current population of North America. Diabetes now affects seven percent of the world's adult population. The regions with the highest comparative prevalence rates are North America, where 10.2 % of the adult population have diabetes, followed by the Middle East and North Africa Region with 9.3%. The regions with the highest number of people living with diabetes are Western Pacific, where some 77 million people have diabetes and South East Asia with 59 million. India is the country with the most people with diabetes, with a current figure of 50.8 million, followed by China with 43.2 million. Behind them the United States (26.8 million); the Russian Federation (9.6 million);

Brazil (7.6 million); Germany (7.5 million); Pakistan (7.1 million); Japan (7.1 million); Indonesia (7 million) and Mexico (6.8 million). When it comes to the percentage of adult population living with diabetes, the new data reveal the devastating impact of diabetes across the Gulf Region, where five of the Gulf States are among the top ten countries affected. The Pacific island nation of Nauru has the world's highest rate of diabetes, with almost a third of its adult population (30.9%) living with the disease. It is followed by the United Arab Emirates (18.7%); Saudi Arabia (16.8%); Mauritius (16.2%); Bahrain (15.4%); Reunion (15.3%); Kuwait (14.6%); Oman (13.4%); Tonga (13.4%) and Malaysia (11.6%)[3].

2. Literature Review

A few studies have been conducted in measuring the progress of the research in diabetes worldwide and in Indian context in the past. Lewin(2008)[4] studied world diabetes mellitus publications during 1984-2005, using MEDLINE database and indicated that the publication growth of articles parallels the increase in diagnosed cases of diabetes mellitus (both type 1 and type 2 together) and the literature relating to type 1 diabetes mellitus has saturated, while that of type 2 showed the increase over time. Haynes[5] studied author self-citation in the diabetes literature. Krishnamoorthy et al[6] studied world diabetes literature during 1995-2004, using MEDLINE database. Somogyl (2001)[7] made an interesting correlation between national bibliometric and health indicators in diabetes.

3. Aims & Objectives

The main objective of this study is to analyze the diabetes research in India, China and Brazil, as reflected in its publications output during 2000-09. In particular, the study focuses on the following objectives: (i) To study the research output, publication share, rank and global burden of the diabetes of most productive countries of the world, (ii) To study the research output, growth and citation impact of research in India, China and Brazil, (iii) to study of patterns of international collaboration in of India, China and Brazil and (iv) To study research profile of leading institutions of India, China and Brazil.

4. Methodology and Source of Data

The Scopus Citation database has been used for retrieving the publication data in diabetes research for the 10 years (2000-2009). For citations data, three years, two year and one year citations window has been used for computing average citations per paper during 2000-2007, 2008 and 2009. The search strategy on diabetes literature was carried out using the following key words strategy suggested by Arunachalam and Gunasekaran[8], Ratnakar and Satynarayana[9] and Rosalind A. Maria[10]

((((TITLE-ABS-KEY(diabete* OR niddm OR iddm OR mody OR mrdm OR fcpd)) OR (TITLE-ABS-KEY(hyperglycem* OR hypoglycem* OR hyperglcaem*) OR (islet transport* OR islet encapsulation OR islet cryop* OR islet neogen* OR islet culture*)) OR (TITLE-ABS-KEY(insulin resist* OR insulin signaling OR insulin senstivity OR insulin receptor)) OR (TITLE-ABS-KEY(glucose transport **OR** resistin OR pancreatic regeneration)) AND (AFFIL(china)) AND PUBYEAR AFT 1999 AND PUBYEAR BEF 2010)))

For identifying literature on three types of diabetes and for different diabetes complications, different keywords strategies were developed. For calculating the international collaborative papers, a separate search strategy was prepared.

5. Analysis

5.1 Research Output of Most Productive Countries

In overall, the global publications share of top 16 most productive countries in diabetes research vary from 1.29% to 29.25% during the ten years period (2000-2009). Among these 16 most productive countries in diabetes research, USA scored the 1st rank, with global publications share of 29.25%. U.K comes at 2nd rank with 8.50% global publications share, followed by Japan, Germany, Italy, France and China (with their global publications share ranging from 3.48% to 6.27%). Spain, Netherlands, Sweden and India ranks at 8th to 11th positions, with their global publications share varying from 2.13% to 2.96% during 2000-09. The countries that rank between 12th to 16th positions are Switzerland, S. Korea, Brazil, Turkey and Belgium with their global publications share less than 2% (varying from 1.29% to 1.45%). (Table 1)

Table 1. Global Publications Output, Publications Share and Rank of Top 16 Most Productive Countries in Diabetes Research, 2000-2009

Countries	No. of Papers			% share of Papers			Rank		
	2000-09	2000	2009	2000-09	2000	2009	2000-09	2000	2009
USA	80094	4943	9977	29.25	29.52	27.15	1	1	1
UK	23281	1480	3040	8.50	8.84	8.27	2	2	2
Japan	17167	1385	2087	6.27	8.27	5.68	3	3	3
Germany	15223	1023	2023	5.56	6.11	5.51	4	4	4
Italy	12410	682	1821	4.53	4.07	4.96	5	6	6
France	10676	777	1389	3.90	4.64	3.78	6	5	7
China	9520	211	2017	3.48	1.26	5.49	7	13	5
Spain	8104	410	1213	2.96	2.45	3.3	8	8	8
Netherlands	6451	340	954	2.36	2.03	2.6	9	9	10
Sweden	6393	472	814	2.33	2.82	2.22	10	7	11
India	5839	229	1164	2.13	1.37	3.17	11	11	9
Switzerland	3974	238	565	1.45	1.42	1.54	12	10	15
South Korea	3942	155	734	1.44	0.93	2	13	14	12
Brazil	3907	125	729	1.43	0.75	1.98	15	16	13
Turkey	3928	129	595	1.43	0.77	1.62	14	15	14
Belgium	3521	219	469	1.29	1.31	1.28	16	12	16
World	273829	16745	36745	100.00	100.00	100.00			

On analyzing the shift in ranking of these 16 countries from 2000 to 2009, it was found that USA, U.K, Japan and Germany continue to rank at 1st to 4th positions, in spite of decline in their publications share from the year 2000 to the year 2009. Among the developing countries China, India, South Korea and Brazil witnessed the major shift in their ranking from 13th to 5th, 11th to 9th, 14th to 12th and 16th to 13th, respectively due to the increase in their global publications share from the year 2000 to the year 2009.

5.2 Research Productivity and Burden of Disease in Global Context.

Based on the percentage of population suffering from diabetes, these 16 most productive countries have been categorized into Highest (with diabetic population from 8.1% to12.3%), Medium (with diabetic population from 5% to 8.0%) and Lowest (with diabetic population from less than 5%) affected countries. Similarly countries are classified according to publications intensity as High (with papers per million populations varying from 460 to 966), Medium (with papers per million populations varying from 238 to 369) and Low (with papers per million population less than 200(Table 2)

It was observed that the high publication intensity countries (namely Sweden, Netherlands, Switzerland, U.K. and Belgium) are found to have generally low to medium prevalence of diabetes (varying from 4.9% to 8.0%) in contrast to medium publications intensity countries (namely U.K., Germany, France, Italy and Spain) having high prevalence of diabetes (varying from 8.7% to 12.3%). As against these two groups of countries, low publication intensity countries (namely Japan, Turkey, India, Brazil and China) have low to medium prevalence of diabetes (varying from 4.5% to 7.4%).In this group, South Korea is the only exception with having high prevalence (9%) of diabetes (Table 2).

Table 2: Publication Output per Million Population and Percent Share of Diabetic Population of Most Productive Countries

Country	2010 Population (20-79) years 000's[10]	DM population and percent share of Diabetic population of productive countries Prevalence 2010National (%) [10]	Total Papers	Papers per Million Population
USA	217335.3	12.3	80094	368.53
Germany	62654.4	12.0	15223	242.97
France	44091.3	9.4	10676	242.13
S.Korea	36602.9	9.0	3942	107.7
Italy	44509.9	8.8	12410	278.81
Spain	33943.8	8.7	8104	238.75
Belgium	7643.9	8.0	3521	460.63
Netherland	11943.4	7.7	6451	540.13
Turkey	49745.9	7.4	3928	78.96
Japan	96665.9	7.3	17167	177.59
Sweden	6618.6	7.3	6393	965.91
India	713498.4	7.1	5839	8.18
Brazil	126326	6.0	3907	30.93
Switzerland	5569.1	4.9	3974	713.58
UK	44056.1	4.9	23281	528.44
China	964301.6	4.5	9520	9.87

5.3 Research Profile of India, China and Brazil in Diabetes Research

On analyzing the diabetes research profile of India, China and Brazil, it was found that China witnessed the highest publications output with 9520 papers in diabetes research, in contrast to India and Brazil's publication output of 5843 papers and 3907 papers respectively during 2000-09. In terms of cumulative growth of diabetes research publications from 2000-04 to 2005-09, China achieved the highest growth rate of 244.24%, followed by Brazil (172.45%) and India (122.64%) (Table 3)

Table 3: Annual Growth of Papers in Diabetes Research, 2000-09

Year	Number of Papers		
	India	China	Brazil
2000	229	211	125
2001	281	222	156
2002	397	355	205
2003	430	526	266
2004	474	829	297
2005	547	1052	377
2006	653	1174	473
2007	792	1391	579
2008	873	1743	700
2009	1167	2017	729
Total	5843	9520	3907
H-Index	70	73	74

Considering the quality and impact of papers (measured in terms of the citations received per paper on a three year window), Brazil scored the highest impact of 6.64, followed by India (4.59) and China (3.82). Among these three countries, Brazil and India witnessed decline in its citation impact from 7.24 to 6.42 and 4.62 to 4.58 citations, respectively in contrast to increase in China from 3.73 to 3.85 citations from 2000-04 to 2005-09 (Table 4).

Table 4. Publication Output and Citation Impact of India, China and Brazil in Diabetes Research, 2000-2009

Period	India			China			Brazil		
	TP	TC	ACPP	TP	TC	ACPP	TP	TC	ACPP
2000-04	1811	8372	4.62	2143	7988	3.73	1049	7594	7.24
2005-09	4032	18447	4.58	7377	28418	3.85	2858	18344	6.42
2000-09	5843	26819	4.59	9520	36406	3.82	3907	25938	6.64
TP= Total Papers; TC=Total Citations; ICP=International Collaborative Papers									

Considering the international collaboration publications output, China achieved the highest international collaborative publication share of 20.88% during 2000-09, followed by Brazil (20.86%) and India (12.54%). The international collaborative publications share of all the three countries has increased from 2000-04 to 2005-09: India (from 10.65% to 13.39%), China (from 18.21% to 21.90%) and Brazil (from 20.59% to 20.95%). The international collaborative research output of Brazil witnessed the highest citations impact per paper of 16.13, followed by India (9.65) and China (9.26). Among these three countries, the citation impact per paper of India increased from 8.83 to 9.94 from 2000-04 to 2005-09, as against decrease from 11.17 to 8.82 in China and 17.39 to 15.68 in Brazil (Table 5).

Table 5. Citation Impact of International Collaborative Papers of India, China and Brazil in Diabetes Research, 2000-2009

Period	India			China			Brazil		
	ICP	TC	ACPP	ICP	TC	ACPP	ICP	TC	ACPP
2000-04	193	1705	8.83	372	4155	11.17	216	3757	17.39
2005-09	540	5370	9.94	1616	14254	8.82	599	9391	15.68
2000-09	733	7075	9.65	1988	18409	9.26	815	13148	16.13
ICP= International Collaborative Papers; TC=Total Citations; ICP=International Collaborative Papers									

5.4 Subject Wise Research Priorities of India, China and Brazil.

In terms of research priorities, the largest emphasis (72.67%) has been given to medicine in world output in diabetes, followed by biochemistry, genetics & molecular biology (28.45%), pharmacology, toxicology & pharmaceutics (9.14%), neurosciences (3.72%), immunology & microbiology (3.66%), agricultural & biological sciences (3.12%) and chemistry (1.56%) (Table 6).

On comparing research emphasis of the India, China and Brazil vis-à-vis the world, it was observed that pharmacology, toxicology & pharmaceutics, agricultural & biological sciences and chemistry has a higher share, compared to the lower share of medicine, biochemistry, genetics & molecular biology, neurosciences and immunology & microbiology in India during 2000-09. In China, comparatively more emphasis has been placed on pharmacology, toxicology & pharmaceutics and chemistry, compared to lower emphasis on medicine, biochemistry, genetics & molecular biology, agricultural & biological sciences, neurosciences and immunology & microbiology. In Brazil, more emphasis has been placed on pharmacology, toxicology & pharmaceutics, agricultural & biological sciences, neurosciences and immunology & microbiology compared to less emphasis on medicine, biochemistry, genetics & molecular biology and chemistry (Table 7).

Table 6. Subject-Wise Break-up of Papers of India, China and Brazil in Diabetic Research, 2000-09

Subject	Number of Papers				% Share of Papers			
	India	China	Brazil	World	India	China	Brazil	World
Medicine	3422	6617	2870	198997	58.57	69.51	73.46	72.67
Biochemistry, Genet. & Mol. Biology	1674	2720	992	77903	28.65	28.57	25.39	28.45

Pharmacology, Toxicology & Pharmaceutics	1460	1123	403	25030	24.99	11.80	10.31	9.14
Agricultural & Biological Sciences	432	258	265	8555	7.39	2.71	6.78	3.12
Chemistry	337	440	58	4273	5.77	4.62	1.48	1.56
Neurosciences	161	309	231	10189	2.76	3.25	5.91	3.72
Immunology & Microbiology	144	272	171	10031	2.46	2.86	4.38	3.6
Total	5843	9520	3907	273829				

Table 7: Relative Index of Publication Output in Diabetes Research under Different Subjects, 2000-2009.

	Number of Papers				Relative Index		
Subject	**India**	**China**	**Brazil**	**World**	**India**	**China**	**Brazil**
Medicine	3422	6617	2870	198997	0.75	0.95	0.97
Biochemistry	1674	2720	992	77903	0.94	1.00	0.85
Pharmacology	1460	1123	403	25030	2.56	1.28	1.08
Agriculture	432	258	265	8555	2.22	0.86	2.08
Chemistry	337	440	58	4273	3.46	2.94	0.91
Neurosciences	161	309	231	**10189**	0.69	0.87	1.52
Immunology	144	272	171	10031	0.63	0.77	1.14

Considering the citation impact of these three countries under different subjects during 2000-09, it was observed that : (i) in medicine, Brazil made the highest citation impact per paper of 6.85, followed by India (4.48) and China (3.18); (ii) in biochemistry, genetics & molecular biology, Brazil made the highest citation impact per paper of 7.22, followed by China (5.45) and India (5.28); (iii) in pharmacology, toxicology & pharmaceutics, Brazil made the highest citation impact per paper of 4.9, followed by India (4.55) and China (4.31); (iv) in agricultural & biological sciences, China made the highest citation impact per paper of 6.31, followed by Brazil (4.68) and India (4.30); (v) in chemistry, Brazil made the highest citation impact per paper of 7.12, followed by China (5.89) and India (5.8zil7); (vi) in neurosciences, China made the highest citation impact per paper of 5.81, followed by India (5.55) and Brazil (5.06) and (vii) in immunology & biology, Brazil made the highest citation impact per paper of 7.65, followed by India (5.04) and China (4.77)(Table 8).

Table 8: Publication Output and Impact in Diabetes Research under Different Subjects, 2000-09

Subject	**India**			**China**			**Brazil**		
	TP	**TC**	**ACPP**	**TP**	**TC**	**ACPP**	**TP**	**TC**	**ACPP**
Medicine	3422	15325	4.48	6617	21028	3.18	2870	19646	6.85
Biochemistry	1674	8832	5.28	2720	14831	5.45	992	7167	7.22
Pharmacology	1460	6647	4.55	1123	4841	4.31	403	2006	4.98
Agriculture	432	1858	4.30	258	1627	6.31	265	1240	4.68
Chemistry	337	1978	5.87	440	2590	5.89	58	413	7.12
Neuro	161	894	5.55	309	1795	5.81	231	1169	5.06
Immunology	144	726	5.04	272	1297	4.77	171	1308	7.65
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper									

5.5 Research Output of India, China and Brazil under Types of Diabetes

Diabetes research output on different types of diabetes shows that the maximum research output in these counties comes from Type 2 diabetes with publications share varying from 16.18% to 21.09%, followed by Type 1 diabetes with publications share varying from 4.84% to 9.54% and gestational diabetes with publications share varying from 0.97% to 2.48% during 2000-09. In type 2 diabetes, India contributes the highest share of 21.09%, followed by China (20.66%) and Brazil (16.18%).   In   Type 1 diabetes, Brazil contributes highest share of 9.34%, followed by India (5.51%) and China (4.84%). In gestational diabetes, Brazil contributes the highest share of 2.48%, followed by India (1.92%) and China (0.97%) (Table 9)

The Brazil achieved the highest citation impact per paper of 5.22 and 8.84 in Type 1 diabetes and Type 2 diabetes, followed by India (4.73 and 5.61) and China (3.74 and 3.76) during 2000-09. In gestational diabetes, India achieved the highest citation impact per paper of 3.61, followed by Brazil (3.09) and China (2.30) during 2000-09

Table 9: Publication Share of Different Types of Diabetes, 2000-09.

Type	Number of Papers				% Share of Papers			
	India	China	Brazil	World	India	China	Brazil	World
Type 1	322	461	365	30406	19.33	18.29	33.36	30.37
Type 2	1232	1967	632	64069	73.95	78.06	57.77	64.00
Gestational	112	92	97	5630	6.72	3.65	8.87	5.62
	1666	2520	1094	100105	100.00	100.00	100.00	100.00

Table 10 : Publication Output and Impact in Diabetes research under Different Types of Diabetes during 2000-2009

Type of Diabetes	India			China			Brazil		
	TP	TC	ACPP	TP	TC	ACPP	TP	TC	ACPP.
Type 1	322	1523	4.73	461	1722	3.74	365	1904	5.22
Type 2	1232	6916	5.61	1967	7395	3.76	632	5588	8.84
Gestational	112	404	3.61	92	212	2.30	97	300	3.09
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper									

5.6 Diabetic Complications and Research Output of India, China and Brazil

In terms of diabetic complications in research as reflected in world output, the largest emphasis has on heart with publications share of 38.99% during 2000-09, followed by kidney (25.56%), eye (11.13% share), nervous system (9.94% share), brain (8.52% share), foot (5.61% share) and tooth (0.25% share).

In China, the maximum complications because of diabetes is on kidney with publications share of 34.44% during 2000-09, followed by heart (29.74% share), eye (24.07% share), nervous system (8.94% share), brain (1.87% share), foot (1.31% share) and tooth (0.83% share).   Compared to China, the maximum complications because of diabetes in India and Brazil are on heart with publications share of 34.11% and 42.68%, followed by kidney (30.70% and 29.78% share), eye (17.83% and 13.12% share), nervous system (13.63% and 10.89% share), brain (2.19% and 1.66% share), foot (1.31% and 1.30% share) and tooth (0.23 and 0.58% share) (Table 11).

On analyzing the diabetic complications in research among India, China and Brazil research output in terms of their publications relative index, it was found that eye, neuropathy and kidney complications with activity index of 1.60, 1.37 and 1.20 showed above world average in India, eye and kidney complications with activity index of 2.16 and 1.20 in China and tooth, eye, kidney, neuropathy and heart

complications with activity index of 2.31, 1.18, 1.16,   1.10 and 1.09 in Brazil (Table 12).

Table 11 : Share of Publication Output in Diabetic Complications during 2000-2009.

Organ	Number of Papers				% Share of Papers			
	India	**China**	**Brazil**	**World**	**India**	**China**	**Brazil**	**World**
Kidney	658	1033	413	30753	30.70	34.44	29.78	25.56
Eye	382	722	182	13389	17.83	24.07	13.12	11.13
Heart	731	892	592	46910	34.11	29.74	42.68	38.99
Neuropathy	292	268	151	11955	13.63	8.94	10.89	9.94
Brain	47	56	23	10245	2.19	1.87	1.66	8.52
Tooth	5	3	8	300	0.23	0.10	0.58	0.25
Foot	28	25	18	6754	1.31	0.83	1.30	5.61
Total of India	2143	2999	1387	120306	100.00	100.00	100.00	100.00

Table 12 : Relative Index of Publication Output in Diabetic Complications during 2000-2009.

Organ	Number of Papers				Relative Index		
	India	**China**	**Brazil**	**World**	**India**	**China**	**Brazil**
Kidney	658	1033	413	30753	1.20	1.35	1.16
Eye	382	722	182	13389	1.60	2.16	1.18
Heart	731	892	592	46910	0.87	0.76	1.09
Neuropathy	292	268	151	11955	1.37	0.90	1.10
Brain	47	56	23	10245	0.26	0.22	0.19
Tooth	5	3	8	300	0.94	0.40	2.31
Foot	28	25	18	6754	0.23	0.15	0.23
Total of India	2143	2999	1387	120306	1.00	1.00	1.00

Considering the impact of these three countries on diabetic complications, (i) Brazil witnessed the highest citations impact per paper of 9.54 on heart, followed by India (4.81) and China (4.23), (ii) Brazil witnessed the highest citations impact per paper of 8.95 on eye, followed by India (4.25) and China (1.62), (iii) Brazil witnessed the highest citations impact per paper of 7.69 on kidney, followed by India (4.81) and China (4.23), (iv) Brazil witnessed the highest citations impact per paper of 6.26 on neuropathy, followed by India (4.10) and China (2.35), (v) China witnessed the highest citations impact per paper of 3.67 on tooth, followed by Brazil (1.00) and India (0.40), (vi) India witnessed the highest citations impact per paper of 1.75 on foot, followed by Brazil (10.61) and China (0.56)(Table 13).

Table 13 : Publication Output and Impact in Diabetic Complications Research during 2000-2009.

Organ	India			China			Brazil		
	TP	**TC**	**ACPP**	**TP**	**TC**	**ACPP**	**TP**	**TC**	**ACPP**
Kidney	658	3168	4.81	1033	4365	4.23	413	3175	7.69
Eye	382	1622	4.25	722	1171	1.62	182	1628	8.95
Heart	731	5230	7.15	892	5941	6.66	592	5647	9.54
Neuropathy	292	1197	4.10	268	630	2.35	151	945	6.26
Brain	47	66	1.40	56	90	1.61	23	92	4.00

Tooth	5	2	0.40	3	11	3.67	8	8	1.00
Foot	28	49	1.75	25	14	0.56	18	11	0.61
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper									

5.7 Research Profile of Prolific Institutions of India, China and Brazil

The research profile of 10 most productive institutions in diabetic research of India, China and Brazil is presented in Tables 14-16. Of these, Brazil's institutions contributes the highest publication share of 76.4% in the country's cumulative research output, followed by China (29.64 %) and India (27.16%) during 2000-09. The highest impact of 6.59 citations per paper is achieved by India's productive institutions, followed by Brazil (6.28 citations per paper) and China (4.40 citations per paper) during 2000-2009. Among these countries, Brazil's productive institutions scored the highest average h-index of 24.3, followed by India (20.7) and China (18.2) during 2000-09.

Table 14 : Publication Output, Impact and H-Index of Productive Institutions of India in Diabetic research during 2000-2009.

S.No.	Name of Institution	TP	TC	ACPP	h-index
1.	All India Institute of Medical Sciences, New Delhi	368	2840	7.72	37
2.	Annamalai University, Annamalainagar	224	1271	5.67	25
3.	Postgraduate Institute of Medical Education and Research, Chandigarh	205	591	2.88	15
4.	Madras Diabetes Research Foundation, Chennai	191	1707	8.94	29
5.	Christian Medical College, Vellore	108	302	2.8	12
6.	University of Madras, Chennai	105	559	5.32	17
7.	National Institute of Pharmaceutical Education and Research, Mohali	103	962	9.34	20
8.	King Edward Memorial Hospital, Mumbai	95	881	9.27	17
9.	Sanjay Gandhi Postgraduate Institute of Medical Sciences Lucknow	95	462	4.86	14
10.	Diabetes Research Centre, Chennai	93	880	9.46	21
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper					

Table 15 : Publication Output, Impact and H-Index of Productive Institutions of China in Diabetic research during 2000-2009.

S.No.	Name of Institution	TP	TC	ACPP	h-index
1.	Peking University	463	2313	5	27
2.	Shanghai Jiaotong University	431	2141	4.97	24
3.	Huazhong University of Science and Technology	323	1174	3.63	20
4.	Zhejiang University	261	756	2.9	17
5.	Sichuan University	253	570	2.25	12
6.	Fudan University	247	1345	5.45	20
7.	Sun Yat-Sen University	234	1205	5.15	19
8.	China Medical University Hospital Taichung	225	1961	8.72	18
9.	General Hospital of People's Liberation Army	218	550	2.52	14

10.	Capital Medical University China	167	407	2.44	11
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper					

Table 16 : Publication Output, Impact and H-Index of Productive Institutions of Brazil in Diabetic research during 2000-2009.

S.No.	Name of Institution	TP	TC	ACPP	h-index
1.	Universidade de Sao Paulo	1019	6495	6.37	46
2.	Universidade Federal de Sao Paulo	401	1629	4.06	27
3.	Universidade Estadual de Campinas	364	2775	7.62	29
4.	Universidade Federal do Rio Grande do Sul	226	2131	9.43	31
5.	UNESP-Universidade Estadual Paulista	211	729	3.45	19
6.	Universidade Federal do Rio de Janeiro	176	1657	9.41	20
7.	Hospital de Clinicas de Porto Alegre	168	924	5.5	19
8.	Hospital das Clinicas da FMUSP	164	1000	6.1	20
9.	Universidade Federal de Minas Gerais	144	887	6.16	18
10.	Universidade do Estado do Rio de Janeiro	112	527	4.71	14
TP=Total Papers; TC=Total Citations; ACPP=Average Citations per Paper					

6. Conclusion

There is an urgent need for governments to face the challenge of diabetes epidemic. At the same time, investments must be made in diabetes R&D, care and management, including diabetes education, to enable the millions of people with diabetes to lead full and productive lives. There is a need to developed new training courses and developed sufficient trained manpower, besides increasing the international collaboration efforts in this area. Diagnosis, treatment, management and prevention of diabetes require integrated health systems, delivery of care down to primary care level, and supportive policies outside the health sector. System-level changes and improvement in political and organizational environment is required within which diabetes care is provided.

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