

RANKING OF INDIAN PHARMACEUTICAL INSTITUTIONS FOR THEIR RESEARCH PERFORMANCE DURING 2000-2009

B.M.Gupta*, Har Kaur, Adarsh Bindu**, Anju** and Nandini Sharma****

*National Institute of Science, Technology & Development Studies,
New Delhi 110 012, bmgupta1@gmail.com

**Government Medical College & Hospital, Chandigarh

ABSTRACT

The present study undertakes the ranking of the Indian most productive institutions in pharmaceutical science for their research output published during 2000-2009. The publications output of these productive institutions is judged on the basis of various quantitative indicators, such as the total number of raw papers and qualitative indicators, such as the average number of citations per paper and h-index value, and also in terms of a new composite indicator, which combines quantitative and qualitative aspects.

Key Word: Ranking, Pharmacology research.

Introduction

Pharmaceutical science and technology had made commendable progress during the last fifty years worldwide leading to a dramatic change in the profession and education of pharmacy. Formal Pharmacy education in India was started in 1937 at Banaras Hindu University. Before India attained independence, there were only three institutions i.e. Banaras Hindu University, Panjab University and L.M.College, Ahmedabad which offered pharmacy degree programs. At present, a variety of pharmacy degree programs are offered in India by number of institutions like Diploma in Pharmacy (DPharm), Bachelor of Pharmacy (B.Pharm), Master of Pharmacy (MPharm), Master of Science in Pharmacy (M.Sc Pharm), Doctor of Pharmacy (Pharm D) and Doctor of Philosophy in Pharmacy (Ph.D). Recently, M.Pharm programs on industrial pharmacy, quality assurance and pharmaceutical

biotechnology have been introduced. Six National Institute of Pharmaceutical Education & Education and Research (NIPERs) in India have been set up to offer MS (Pharm), MTech (Pharm) and higher-level degrees to achieve the excellence in pharmacy and pharmacy-related education. Beside these, in 2007, there were approx. 854 institutions with an intake of 52,000 students in the B.Pharm program and 583 institutions that train 34,000 students in the D.Pharm program. The private sector, which accounted for 10% of students in 1980's now accounts for 91% of all pharmacy students admitted¹. To regulate the practice, education and profession of pharmacy, Pharmacy Act was enacted in 1948. Pharmacy Council of India (PCI) under the Pharmacy Act of 1948 and All India Council for Technical Education (AICTE), are the authorities to regulate pharmacy education in India².

R&D is the key to the future of pharmaceutical industry and substantial pharma related R&D is carried out in public funded research organizations of Council of Scientific & Industrial Research, Indian Council of Medical Research, etc. In addition, the Department of Science and Technology and Department of Biotechnology have been providing extra-mural funds to projects through its various schemes. Some of the most significant government schemes for support of R&D activities in pharmaceutical sector are: (i) DST's Drugs & Pharmaceutical Research Program (ii) CSIR's Open Source Drug Discovery Program (iii) CSIR's New Millennium Indian Technology Leadership Initiatives (NMITLI) (iv) DBT'S Small Business Innovation Research Initiative (SBIRI) and Biotechnology Industry Partnership Programme (BIPP). Globally, the Indian pharmaceutical industry ranks 4th in terms of volume and 13th in terms of value.

Several Studies previously ranked the Indian institutions [3-4] engineering & technological institutions [5] and Indian universities [6-7] by using various performance indicators, using the scientific research output of participating institutions.

2. Objectives

The main objective of this study is to analyze the 10 years (2000-2009) research output data of 24 most productive institutions in India for ranking them in pharmaceutical sciences. In particular, the study focuses on the ranking of top 24 most productive Indian institutions, which are judged on the basis of various quantitative indicators, such as the total number of raw papers and qualitative indicators, such as the average number of citations per paper and h-index value, and also

in terms of a new composite indicator, which combines quantitative and qualitative aspects.

3. Methodology and Source of data

The study uses the 10 years publication data (2000-2009) of leading institutions of India in the field of pharmaceutical sciences from the international bibliographical multidisciplinary SCOPUS database. A total of 24 institutions with comparatively high output in publications during a ten-year period from 2000-2009 were identified. Citations received by the papers (P) are considered for the first three-years from the date of their publications (C), which allows the average number of citations per paper (C/P) to be computed for each of 24 institutions. H-Index for these 24 institutions for the same period (i.e. 2000-2009) was determined from the Scopus bibliographical database. There are several ranking methods used here for comparison. We have based our ranking on quantitative parameters (the number of raw count of papers (P), qualitative parameters (mean citation rate (C/P)), and a combination of both quantitative and qualitative parameters (h-index and p-index). According to Dr Gangan Prathap, who suggested the possible use of p-index for ranking institutions, combines both quantitative and qualitative parameters. According to him p-index can be defined as $(C^2/P)^{(1/3)}$.

4. Analysis: A total of 24 institutions with 2009, with an average of 4.56 citations per research output paper.

S.No.	Affiliation	P	C	C/P	h-Index	p-Index
1.	Indian Institute of Chemical Technology, Hyderabad	111	8637	7.77	41	13.53
2.	Central Drug Research Institute, Lucknow	845	3698	4.38	29	8.42
3.	Jamia Hamdard	628	1955	3.11	23	6.08
4.	University of Madras, Chennai	621	2944	4.74	25	8.02
5.	Panjab University Institute of Pharmaceutical Sciences, Chandigarh	607	3180	5.24	36	8.50
6.	Jadavpur University, Kolkata	553	2217	4.01	27	6.90
7.	Annamalai University, Annamalainagar	541	2044	3.78	25	6.58
8.	National Institute of Pharmaceutical Education and Research, Mohali	533	3439	6.45	35	9.36
9.	Dr Hari Singh Gour Visvidalaya, Sagar	506	2122	4.19	26	6.90
10.	All India Institute of Medical Sciences, New Delhi	496	1709	3.45	28	6.01
11.	National Chemical Laboratory, Pune	401	2927	7.30	31	9.24
12.	Andhra University, Visakhapatnam	374	767	2.05	18	3.87
13.	The M.S. University of Baroda	318	988	3.11	19	4.84
14.	Indian Institute of Toxicological Research, Lucknow	314	1303	4.15	20	5.84
15.	Indian Institute of Science, Bangalore	299	1536	5.14	21	6.63
16.	Dr Reddy Laboratory Ltd, Hyderabad	276	1346	4.88	20	6.24
17.	Postgraduate Institute of Medical Education & Research, Chandigarh	276	787	2.85	17	4.36
18.	Manipal College of Pharmaceutical Science	260	480	1.85	15	3.20
19.	Kakaitya University, Warangal	248	599	2.42	18	3.77
20.	Bharati Vidyapeeth University, Pune	244	564	2.31	14	3.64
21.	University of Delhi	242	1450	5.99	22	6.85
22.	Indian Institute of Chemical Biology, Kolkata	219	963	4.40	22	5.39
23.	University of Rajasthan	212	482	2.27	14	3.43
24.	Bhabha Atomic Research Center, Mumbai	208	926	4.45	20	5.34

of 208 and above publications during 2000-2009 were identified as productive institutions. The publication data pertaining to these institutions on their publications output (P), citations (P) received by these publications on a three years citations window, average citations per (C/P), h-index value and p-index value, is presented in Table 1. These institutions together contribute 10332 papers with 39.09% share in the cumulative publication output of India in pharmaceutical sciences during the same period. The total 47063 citations were received by the papers published from these institutions during 2000-

Table 1. Ranking of Top 24 Indian Institutions involved in Pharmaceutical Research, 2000-09

Although there are several ways of ranking as suggested in the literature, but we present here ranking of pharmaceutical sciences institutions according to quantitative indicators, such as the total number of raw papers, qualitative indicators, such as the average number of citations per paper, and composite indicators which combines quantity and quality aspects, such as h-index value and p-index. The

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S.No.	Ranking on			
	P	C/P	h-Index	p-Index
1	Indian Institute of Chemical Technology, Hyderabad (1111)	Indian Institute of Chemical Technology, Hyderabad (7.77)	Indian Institute of Chemical Technology, Hyderabad (41)	Indian Institute of Chemical Technology, Hyderabad (13.53)
2	Central Drug Research Institute, Lucknow (845)	National Chemical Laboratory, Pune (7.30)	Panjab University Institute of Pharmaceutical Sciences, Chandigarh (36)	National Institute of Pharmaceutical Education and Research, Mohali (9.36)
3	Jamia Hamdard (628)	National Institute of Pharmaceutical Education and Research, Mohali (6.45)	National Institute of Pharmaceutical Education and Research, Mohali (35)	National Chemical Laboratory, Pune (9.24)
4	University of Madras, Chennai (621)	University of Delhi (5.99)	National Chemical Laboratory, Pune (31)	Panjab University Institute of Pharmaceutical Sciences, Chandigarh (8.50)
5	Panjab University Institute of Pharmaceutical Sciences, Chandigarh (607)	Panjab University Institute of Pharmaceutical Sciences, Chandigarh (5.24)	Central Drug Research Institute, Lucknow (29)	Central Drug Research Institute, Lucknow (8.42)
6	Jadavpur University, Kolkata (553)	Indian Institute of Science, Bangalore (5.14)	All India Institute of Medical Sciences, New Delhi (28)	University of Madras, Chennai (8.02)
7	Annamalai University, Annamalainagar (541)	Dr Reddy Laboratory Ltd, Hyderabad (4.88)	Jadavpur University, Kolkata (27)	Dr Hari Singh Gour Visvidalaya, Sagar (6.90)
8	National Institute of Pharmaceutical Education and Research, Mohali (533)	University of Madras, Chennai (4.74)	Dr Hari Singh Gour Visvidalaya, Sagar (26)	Jadavpur University, Kolkata (6.90)
9	Dr Hari Singh Gour Visvidalaya, Sagar (506)	Bhabha Atomic Research Center, Mumbai (4.45)	University of Madras, Chennai (25)	University of Delhi (6.85)
10	All India Institute of Medical Sciences, New Delhi (496)	Indian Institute of Chemical Biology, Kolkata (4.40)	Annamalai University, Annamalainagar (25)	Indian Institute of Science, Bangalore (6.63)
11	National Chemical Laboratory, Pune (401)	Central Drug Research Institute, Lucknow (4.38)	Jamia Hamdard (23)	Annamalai University, Annamalainagar (6.58)
12	Andhra University, Visakhapatnam (374)	Dr Hari Singh Gour Visvidalaya, Sagar (4.19)	University of Delhi (22)	Dr Reddy Laboratory Ltd, Hyderabad (6.24)
13	The M.S. University of Baroda (318)	Indian Institute of Toxicological Research, Lucknow (4.15)	Indian Institute of Chemical Biology, Kolkata (22)	Jamia Hamdard (6.08)
14	Indian Institute of Toxicological Research, Lucknow (314)	Jadavpur University, Kolkata (4.01)	Indian Institute of Science, Bangalore (21)	All India Institute of Medical Sciences, New Delhi (6.01)
15	Indian Institute of Science, Bangalore (299)	Annamalai University, Annamalainagar (3.78)	Indian Institute of Toxicological Research, Lucknow (20)	Indian Institute of Toxicological Research, Lucknow (5.84)
16	Dr Reddy Laboratory Ltd, Hyderabad (276)	All India Institute of Medical Sciences, New Delhi (3.45)	Dr Reddy Laboratory Ltd, Hyderabad (20)	Indian Institute of Chemical Biology, Kolkata (5.39)
17	Postgraduate Institute of Medical Education & Research, Chandigarh (276)	Jamia Hamdard, New Delhi (3.11)	Bhabha Atomic Research Center, Mumbai (20)	Bhabha Atomic Research Center, Mumbai (5.34)
18	Manipal College of Pharmaceutical Science (260)	The M.S. University of Baroda (3.11)	The M.S. University of Baroda (19)	The M.S. University of Baroda (4.84)
19	Kakaitya University, Warangal (248)	Postgraduate Institute of Medical Education & Research, Chandigarh (2.85)	Andhra University, Visakhapatnam (18)	Postgraduate Institute of Medical Education & Research, Chandigarh (4.36)
20	Bharati Vidyapeeth University, Pune (244)	Kakaitya University, Warangal (2.42)	Kakaitya University, Warangal (18)	Andhra University, Visakhapatnam (3.87)
21	University of Delhi (242)	Bharati Vidyapeeth University, Pune (2.31)	Postgraduate Institute of Medical Education & Research, Chandigarh (17)	Kakaitya University, Warangal (3.77)
22	Indian Institute of Chemical Biology, Kolkata (219)	University of Rajasthan (2.27)	Manipal College of Pharmaceutical Science (15)	Bharati Vidyapeeth University, Pune (3.64)
23	University of Rajasthan (212)	Andhra University, Visakhapatnam (2.05)	Bharati Vidyapeeth University, Pune (14)	University of Rajasthan (3.43)
24	Bhabha Atomic Research Center, Mumbai (208)	Manipal College of Pharmaceutical Science (1.85)	University of Rajasthan (14)	Manipal College of Pharmaceutical Science (3.20)

various possibilities of ranking these institutions using the four indications mentioned above are presented in Table 2.

Table 2. Ranking of Pharmaceutical Institutions based on Total Papers (P), Average Citations per Paper (C/P), h-Index and p-Index

On ranking the top 24 institutions based on performance index value of p, we find that the Indian Institute of Chemical Technology, Hyderabad tops the list with p-value of 13.53, followed by National Institute of Pharmaceutical Education and Research, Mohali (with p value of 9.36), National Chemical Laboratory, Pune (with p value of 9.24), Panjab University Institute of Pharmaceutical Sciences, Chandigarh (with p value of 8.50), Central Drug Research Institute, Lucknow (with p value of 8.42), University of Madras, Chennai (with p value of 8.02), Dr Hari Singh Gour Visvidalaya, Sagar (with p value of 6.90), Jadavpur University, Kolkata (with p value of 6.90), University of Delhi (with p value of 6.85), Indian Institute of Science, Bangalore (with p value of 6.63), Annamalai University, Annamalainagar (with p value of 6.58), Dr Reddy Laboratory Ltd, Hyderabad (with p value of 6.24), Jamia Hamdard (with p value of 6.08), All India Institute of Medical Sciences, New Delhi (with p value of 6.01), Indian Institute of Toxicological Research, Lucknow (with p value of 5.84), Indian Institute of Chemical Biology, Kolkata (with p value of 5.39), Bhabha Atomic Research Center, Mumbai (with p value of 5.34), The M.S. University of Baroda (with p value of 4.84), Postgraduate Institute of Medical Education & Research, Chandigarh (with p value of 4.36), Andhra University, Visakhapatnam (with p value of 3.87), Kakaitya University, Warangal (with p value of 3.77), Bharati Vidyapeeth University, Pune (with p value of 3.64), University of Rajasthan (with p value of 3.43) and Manipal College of Pharmaceutical Science (with p value of 3.20).

On comparing the performance of top 24 institutions on the basis of p-value and with those based on other parameters, it was observed that only Indian Institute of Chemical Technology, Hyderabad remains holds the 1st rank in terms of quantity of papers (1111), quality of papers (7.77), h-index value of (41) and p-index value of (13.53), while other institutions witnessed a

major shift/change in their ranking positions as follows:

(i) As per quantity of papers, CDRI, Lucknow holds the 2nd rank with 845 papers, but moves down to 5th position both as per its h-index value of 29 and p-index of 8.42, and further moves down to 11th rank in terms of average citations per paper (4.38), (ii) NCL, Pune ranks at 2nd position in terms of average citations per paper (7.30), moves down to 3rd place as per p-index (9.24), further moves down to 4th and 11th positions for its h-index (31) and quantity of papers (401), respectively. (iii) In terms of h-index value, UIPS-PU, Chandigarh achieved the 2nd rank but moves down to 4th position according to p-index value (8.50) and to 5th position in terms of both the quantity of papers (607) and quality of papers (5.24) (iv) NIPER, Mohali although holds the 2nd rank in terms of p-index (9.36) but moves down to 3rd position both as per h-index (35) and quality of papers (6.45), further moves down to 8th position in terms of quantity of papers (533). (v) Jamia Hamdard, Delhi although holds the 3rd rank in terms of number of papers (628) but moves down to 11th rank in terms of h-index (23), 13th rank as per p-index (6.08) and 17th rank in terms of quality of papers (3.11), (vi) University of Madras although holds the 4th rank as per quantity of papers (621), but moves down to 6th position as per p-index (8.02), 8th position in terms of ACPP (4.74) and 9th position as per h-index (25). (vii) In terms of number of papers, Jadavpur University holds the 6th rank with 553 papers but moves down to 7th, 8th and 14th position in terms of h-index (27), p-index (6.90) and quality of papers (4.01), respectively.

In sharp contrast, (i) Jamia Hamdard, Delhi which scores 3rd rank in terms of quantity of papers (628) but holds 17th rank in terms of quality of papers (3.11) and 11th and 13th

position in terms of h-index (23) and p-index (6.08). (ii) BARC, Mumbai holds 24th rank in terms of number of papers (208) but considerably improved its rank to 9th position in terms of average citation per paper (4.45) and 17th rank both in terms of h-index (20) and p-index (5.34). (iii) IICB, Kolkata witnessed the major shift in its rankings from 22nd rank according to number of papers (219), moves to 10th, 13th and 16th position according to ACPP (4.40), h-index (22) and p-index (5.39) respectively. (iv) Similarly University of Delhi witnessed the major shift in its rankings from 21st position according to number of papers (242), moves to 4th, 9th, and 12th position according to quality of papers (5.99), p-index (6.85) and h-index (22).

Conclusion

The research performance of Indian institutions, actively engaged in pharmaceutical research witnessed a major shift in their rankings measured on the basis of four indicators, viz total papers publication output, impact in terms of average citations received per paper, h-index value and performance indicator p-index. IICT, Hyderabad tops the list in terms of all for indicators i.e. quantity of papers, quality of papers, h-index and p-index. The 2nd rank is achieved by CDRI, Lucknow by publishing 845 papers, NCL, Pune by achieving the impact of 7.30 citations per paper, UIPS-PU, Chandigarh by scoring h-index value of 36 and NIPER, Mohali registered the p-index of 9.36. Conclude that although there are several ranking methods used in literature for comparison, but the authors of this communication have based the ranking on quantitative parameters such as the number of raw count of papers (P), qualitative parameters (such as mean citation rate (C/P)), and a combination of both quantitative and

qualitative parameters (such as h-index and p-index). The authors leave it to the readers to decide which method is the best and most suitable in their own environment.

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