

Research output of India compared to BRICS countries in publishing pharmacology, toxicology and pharmaceuticals research papers

Virendra S. Ligade and Swapnil Dengale

Brazil, Russia, India, China and South Africa, known as BRICS countries, are on a progressive path not only in terms of economy, but also in terms of publishing scientific and engineering research publications. The literature search shows that 17.3% share of the world's research papers in science and engineering is contributed by the BRICS countries. India is in the second position amongst these countries in terms of publishing research papers in science and engineering. Patenting trends and amount spent on research and development by BRICS countries are also encouraging. Many of the multinational pharmaceutical companies have seen highest growth in terms of revenue in the BRICS countries. Taking note of all these aspects, the present study was aimed at comparing the research output of India with other BRICS countries in terms of research publications in the area of pharmacology, toxicology and pharmaceuticals.

The BRICS countries – Brazil, Russia, India, China and South Africa – represent the growing economy. These countries account for 42% of the world's population, representing approximately 3 billion people with 18% of the world's GDP¹. According to the Innovation Cooperation Plan (2017–2020) framed by BRICS, innovation is the main driving force for continuous development and primary role in promoting economic growth of the said regions. Further, the Plan outlines the commitment of the BRICS countries towards innovation-based research, establishing science parks and bolstering training of technology transfer². The literature search shows that 17.3% share of the world's research papers in the field of science and engineering was contributed by the BRICS countries in 2011 compared to 7.6% in 1995. Also, 31.2% of doctorates in science and engineering belong to the BRICS countries. The number of research papers published is relative to the number of researchers, whereas the gross expenditure on R&D is directly proportional to the number of research papers published. In terms of science and engineering research publications, India was in the second position in 2011 (ref. 3). The country's performance in terms of R&D spending is not quite encouraging. India stands last among members of BRICS with respect to R&D spending. The R&D spending by China is more than twice that of India. However, China is way ahead of other members of BRICS with regard to science and technology journal articles and patents filed⁴. In the pharma field, the scenario has changed in terms of patenting and licensing. Due to

high demand of generic drugs, there is drastic development in this field. Indian pharma market is dominated by generic drugs (71%), followed by over-the-counter medicines (19%) and patented drugs (10%)⁵. Research in the area of pharmacology, toxicology and pharmaceuticals is on the rise in India. In the present study we compared the research output of India with the other BRICS countries in terms of research publications in the area of pharmacology, toxicology and pharmaceuticals.

Methodology

To achieve the said objective, data pertaining to research publications have been obtained from SciVal⁶. This database summaries comprehensive research performance among multidisciplinary research areas. It compares the research performance of institutions and countries. It also analyses the research trends with citation, usage data and identifies top performers in the respective research field. The study period was between 2013 and 2017. Search was conducted only specific to Brazil, Russia, India, China and South Africa. Overall research publications in the said area were analysed, mentioning the total number of publications and time period. The data are presented in tabular form.

Results and discussion

The global number of research publications in the area of pharmacology, toxicology and pharmaceuticals was 455,418, with the United States accounting for

98,249, followed by China with 78,828 and India with 52,834. The BRICS countries showed significant growth in publishing research papers during 2013–2017. Overall the number of research publications under the said category by the BRICS countries was 151,362, with 8.3% growth, 792,028 citations, the number of authors was 374,132 and citations per publication 5.2. Table 1 shows that under pharmacology, toxicology and pharmaceuticals, the total number of publications in the subcategory of pharmacology is 59,383, growth is 16.6%, citations 354,422, authors 182,072 and citations per publication is 6. In the subcategory of pharmaceutical science, the total number of publications is 51,153, growth is –1.5%, citations 226,907, authors 139,369 and citations per publication is 4.4. Under the subcategory of drug discovery, the total number of publications is 45,780, growth is 7.2%, citations 299,692, authors 135,040 and citations per publication is 6.5. In general pharmacology, toxicology and pharmaceuticals category, the total number of publications is 26,008, growth is –17.4%, citations 50,800, authors 76,200 and citations per publication is 2. In toxicology subcategory, the total number of publications is 17,017, growth is 42.5%, citations 121,543, authors 57,586 and citations per publication is 7.1. Under miscellaneous subcategory of pharmacology, toxicology and pharmaceuticals, the total number of publications is 2489, growth is 94.2%, citations 9829, authors 7768 and citations per publication is 3.9.

From Table 2 it can be observed that from 2013 to 2017, the number of research papers published has been steadily

Table 1. Total research publications output by BRICS countries in the subject area of pharmacology, toxicology and pharmaceuticals⁶

Subject area (subcategory)	Publications (no.)	Publications (growth %)	Citations	Authors	Authors (growth %)	Citations per publication	Field-weighted citation impact
Pharmacology	59,383	16.6	354,422	182,072	33.5	6	0.86
Pharmaceutical science	51,153	-1.5	226,907	139,369	17.7	4.4	0.71
Drug discovery	45,780	7.2	299,692	135,040	28.1	6.5	0.89
General pharmacology, toxicology and pharmaceuticals	26,008	-17.4	50,800	76,200	-3.5	2	0.51
Toxicology	17,017	42.5	121,543	57,586	47.5	7.1	0.95
Pharmacology, toxicology and pharmaceuticals (miscellaneous)	2489	94.2	9829	7768	150.7	3.9	0.89

Table 2. Year-wise research publications contributed by BRICS countries⁶

Year	Brazil	Russia	India	China	South Africa
2017	2662	1246	8301	17,259	574
2016	2495	1838	12,374	16,509	587
2015	2376	1263	10,688	15,056	518
2014	2323	872	10,852	16,281	485
2013	2136	618	10,619	13,723	445
Total	11,992	5837	52,834	78,828	2609

increasing. The total number of papers published by Brazil was 11,992, Russia 5837, India 52,834, China 78,828 and South Africa 2609. Maximum number of research publications was published by China (78,882) followed by India (52,834). In 2017, the total number of research publications was slightly low in India compared to 2016.

Conclusion

There is significant growth of research paper publications in the area of pharmacology, toxicology and pharmaceuticals contributed by the BRICS countries. Overall after the United States and China, India stands in third position and is in the

second place among the BRICS countries as far research publications in pharmacology, toxicology and pharmaceuticals are concerned. India's publishing trend in the said area is encouraging. In order to achieve the top position and to sustain in the said area, Indian scientists need a boost, and we have to create a healthy environment for more innovation and research which are useful to the community.

1. http://www.chinadaily.com.cn/china/2017-07/19/content_30165152.htm (accessed on 5 September 2018).
2. http://english.gov.cn/news/international_exchanges/2017/07/19/content_28147573-9064908.htm (accessed on 1 October 2018).

3. Hasan, S. A. and Luthra, R., *Curr. Sci.*, 2014, **106**, 1654–1657.
4. Janodia, M. D., *Curr. Sci.*, 2015, **108**, 1040–1041.
5. Singh, V., Chakraborty, K. and Vincent, L., *Curr. Sci.*, 2017, **103**, 725–732.
6. <https://scival.com/overview/summary?uri=CountryGroup/12> (accessed during 1–28 September 2018).

*Virendra S. Ligade** is in the Department of Pharmacy Management and Swapnil Dengale is in the Department of Pharmaceutical Quality Assurance, Manipal College of Pharmaceutical Sciences, Manipal Academy of Higher Education, Manipal 576 104, India.

*e-mail: virendral23sl@gmail.com