



A comparative Analysis of Corona virus Research Publications in BRICS organization Countries

¹Mr. Ramesh S. Puttannanavar, ²Mr. Pradeepa H., ³Dr. Rohit R. Patil

¹ Assistant Librarian, Karnataka Samskrit University, Bangalore-560018.

Email - rameshsp2018@gmail.com

² Librarian, ICAT Design and Media College, Bengaluru-560068.

Email - pradeephmlisc@gmail.com

³ Dept. of Library & Information Science, Karnataka University, Dharwad-580003

Email - roth.patil@gmail.com

Abstract: The paper highlights the research contributions of BRICS countries in the Coronavirus outbreak in the 2019 to 2021, as reflected in Web of Science databases. The BRICS countries are Brazil, Russia, India, China and South Africa. There were 41389 publications with 209181 citations and received 5.05 citations per publication. Further study find out that among the countries China is the top most contributed in all the approaches of research field. It also looks in the international collaborations 4050 research paper are published. The study depicts total 3174 highly cited papers was received from all five countries during the study timeline. Study analysis various scientometric tools such as citation, h-index, publication type, prolific authors, authorship pattern, degree of collaboration, most preferred journals, top rated research institutions.

Key Words: BRICS, Corona virus, Scientometrics study, highly cited papers, ICP, ACPP.

1. INTRODUCTION :

Novel coronavirus (CoV) named '2019-nCoV' or '2019 novel coronavirus' or 'COVID-19' by the World Health Organization (WHO) is in charge of the current outbreak of pneumonia that began at the beginning of December 2019 near in Wuhan City, Hubei Province, China. This is a new coronavirus that has not been previously identified in humans. The majority of those infected with the virus will have mild to moderate respiratory symptoms and will recover without the need for medical attention. Some, on the other hand, will become critically unwell and require medical assistance. Serious sickness is more likely to strike the elderly and those with underlying medical disorders such as cardiovascular disease, diabetes, chronic respiratory disease, or cancer. COVID-19 can make anyone sick and cause them to get very ill or die at any age. When an infected person coughs, sneezes speaks, sings, or breathes, the virus spreads in microscopic liquid particles from their mouth or nose. Larger respiratory droplets to smaller aerosols are among the particles. If you are sick, it is critical to adopt respiratory etiquette, such as coughing into a flexed elbow and to stay at home and self-isolate until you heal. Being thoroughly informed on the disease and how it spreads seems to be the best strategy to avoid and slow down transmission. Throughout the COVID-19 pandemic, several corona virus variants have emerged as the virus, SARS-CoV-2, continues to mutate and evolve. Many of these variants' mutations have little or no impact on how the virus affects humans. But others, such as the genetic changes in the delta variant, can make the corona virus more transmissible (contagious) than the original version of SARS-CoV-2 that was discovered in late 2019. In November 2021, a variant of the SARS-CoV-2 corona virus emerged, and was named omicron by the World Health Organization (WHO). WHO currently lists the omicron as a variant of concern. It was first reported to the WHO from South Africa on 24 November. It has been identified in Botswana, Belgium, Hong Kong and Israel. In this situation human beings followed guidelines such as Stay at least 1 metre away from people, wear a well-fitted mask, and wash your hands or use an alcohol-based rub periodically to protect yourself from infection. When it's your turn, get vaccinated and follow



local advice.. As on February 10, 2022, globally 399 600 607 COVID-19 cases have been confirmed across 216 countries and territories, resulting in 5757562 deaths. Scientometric analysis may be considered as a commonly accepted tool to evaluate publication trend of a particular research topic/field quantitatively and qualitatively. The study attempts to provide a Scientometric analysis of BRICS countries publications on the topic “Corona virus” as indexed in Web of Science (WOS) during the study period December 2019 to December 2021 and retrieved on 20th January, 2022 with analysis on the trend of research publications.

2. Objectives of the Study :

The purpose of this study is to explore the main scientific output in order to measure the extent of scientific research in BRICS countries on Corona virus. The specific objectives of this study are a) to identify the year wise distribution of research articles of BRICS countries in the field of Corona virus b) To find out the major contributing authors in the research field. c) To find out the most productive research institutions) To know the international collaborations. e) To find out top sub-fields of covid-19 and f) to find out highly cited papers in research area.

3. Methodology :

The present study data have been collected from Web of science for the period 2019 to 2021 using the following search strategy under “((ALL=(Coronavirus)) OR ALL=(Covid-19)) OR ALL=(SARS-CoV-2)”. A total of 41389 publications were retrieved, the data downloaded and analyzed using MS office-Excel as per objectives of the present study. All articles contributed by the authors (either individually or in collaboration with authors from other organizations/countries) from BRICS countries are Brazil, Russia, India, China and South Africa countries have been considered for the present study.

4. Review of Literature :

Laksham S. et.al (2020) analyzed the global level perspective of Coronavirus research output during the period of 1989 to March 2020 and data was extracted from the Web of Science citation database The finding of the study is 7381 papers are published from 127 countries, among the publication the highest numbers of publications (561) were published in 2019 and received 848 citations, United States (USA) is the most productive country with 2801 publications (37.9% and received 107738 Citations and compare the status of India is 80 publication in the field of Coronavirus research.

Surulinathi, M., Balasubramani, R., & Amsaveni, N., (2020) observed the world trends in perspective of COVID-19 research output from January to April 2020 and data were extracted from the Web of Science citation database. A total of 1658 publications and received 4804 citations came from 78 countries. As compared with top most countries wise China is the highest publication country 523 publication and received 3521 citations. Institution wise 2027 institute involved in covid 19 research among Huazhong University, Science & Technology Wuhan-from China is the highest publications of 46 (583 Citations). The source wise publication pattern British Medical Journal is the ranked one source title published 181 research papers and its impact factor value is 27.60. The top most impact factor journal is New England Journal of Medicine i.e 70.67.

Sidhartha, S. & Shriram P (2020) studied the research output in Corona virus disease 2019(Covid-19) data were retrieved from SCOPUS databases during 01 January 2020 to 6 April, 2020. Total observation of the study is 1630 papers are published, in that communication channel Open access platform is share was 82.88% (1351) of the research documents among the others communication forms. ‘BMJ Clinical Research Ed’ found that highly productive journal with 114(6.99%) research articles. In the international collaboration wise China is the highest productive country with 515 research papers, second place is USA with 308 research papers.

Vysakh., C & Rajendra, B (2020) analyzed the Covid-19 publication pattern in social web during the pandemic situation. A total number of 145 data were collected from various social platforms. Major social platforms are Twitter (143452) publications, News (5251) publications and others are Highlights, Wiki, Video. The forms of document is open access articles did not find any social media attention benefits compared to non-open access articles.

Abdul Gaffar, Sk., et. al (2021) observed that COVID-19 pandemic in India. Data were collected from Web of Science (WoS) during 2019 to 2021, June. During this study period a total of 3024 records are published. Study output is journal wise “Indian Journal of Ophthalmology” was the highest number of publication i.e 99 papers. In terms of international collaboration India is the top most country with 3024 research output and has 2574 total link strengths. Citation wise India has received 21099 citation among the top 20 countries.

Mehmet Oguzhan, AY. et. al (2021) have discuss the global perspective on COVID-19 vaccines literature during January 20, 2021 with the help of keywords “COVID-19” and “vaccine” were data retrieved from Web of Science databases. A total of 2,765 research output and received 24,202 citations during the period. The highest number of productive wise top universities are Harvard University, University of California System and University of London. In



terms of author pattern ship rank one author is Dhama K. and followed by Mahase E, Baric RS. Journal of bimolecular Structure Dynamics stood in the first in terms of highest number of published papers. Study found that English is the communication language of the publications. The United States of America stand the top most productive countries among the other countries, such as China and India. This research work contributions encourage the researcher in the area of corona virus vaccine scientists.

5. Analysis of the Data :

Table 1 show research trends on Corona virus in the BRICS countries during the period of 2019 to 2021. Such BRICS countries are Brazil, Russia, India, China and South Africa. In this study found that these countries contributed 41389 papers. Among these the largest number of papers 22265 (53.79%) is published by China, followed by India 9474 (22.89%), Brazil 5820 (14.06%), South Africa 2257 (5.45%) and Russia 1573 (3.80%). The total 41389 papers contributed by these countries and received 209181 citations during the study time, with the average citation per paper as 5.05. With regard to internal collaboration these countries published 4050 international collaborative papers, among these the largest share of international collaborative publications in total publication output is recorded by China (25.88%), followed by India (27.31%), Brazil (20.37%), South Africa (15.31%) and Russia (11.14%).

Table 1. Research Output of BRICS Countries in Corona virus

Countries	TP	%	TC	ACPP	ICP	%	H-Index
Peoples Republic of China	22265	53.79	NA	NA	1048	25.88	NA
India	9474	22.89	82334	8.69	1106	27.31	99
Brazil	5820	14.06	71422	12.27	825	20.37	94
South Africa	2257	5.45	28842	12.78	620	15.31	62
Russia	1573	3.80	26583	16.90	451	11.14	57
Total	41389	100	209181	5.05	4050	100	

Note: NA- Not Available (since Peoples Republic of China TC, ACP, H-Index data was not available)TP=Total Publication, TC=Total Citation, ACPP= Average citation per paper, ICP= International collaboration paper

Table 2 shows the contribution of top ten eminent authors in BRICS countries on Corona Virus during study plan. In this table authors ranking based on the records, among these top ten authors highly productive author is Zhang, Y contributed 574 (12.56%) articles from China and other countries highly productive authors are followed by Kumar, A contributed 272 articles (16.34%) from India, Giovanetti, M contributed 47 articles (13.95%) from Brazil, De Oliveira, T contributed 30 articles (14.93%) from South Africa and Shoenfeld, Y contributed 28 articles (16.97%) from Russia.

Table 2. Top most Authors in BRICS countries

China		India		Brazil		South Africa		Russia	
Authors	Records	Authors	Records	Authors	Records	Authors	Records	Authors	Records
Zhang Y	574 (12.56%)	Kumar A	272 (16.43%)	Giovanetti M	47 (13.95%)	De Oliveira T	30 (14.93%)	Shoenfeld Y	28 (16.97%)
Wang Y	566 (12.39%)	Kumar S	262 (15.82%)	Scorza FA	45 (13.35%)	Madhi SA	24 (11.94%)	Uversky VN	21 (12.73%)
Li Y	489 (10.70%)	Wiwanitkit V	191 (11.53%)	Finsterer J	42 (12.46%)	Zumla A	21 (10.45%)	Rehm J	20 (12.12%)
Zhang L	466 (10.20%)	Sharma A	155 (9.36%)	Ciccozzi M	32 (9.50%)	Zar HJ	20 (9.95%)	Tsatsakis A	17 (10.30%)
Wang J	465 (10.18%)	Singh S	152 (9.18%)	Martins PR	31 (9.20%)	Blumberg L	18 (8.96%)	Munblit D	15 (9.09%)
Liu Y	456 (9.98%)	Sharma S	129 (7.79%)	Sabino EC	30 (8.90%)	Dzinamarira T	18 (8.96%)	Umar Z	15 (9.09%)



Li J	430 (9.41%)	Kumar P	127 (7.67%)	Santos VS	30 (8.90%)	Nachega JB	18 (8.96%)	Moiseev S	14 (8.48%)
Liu J	396 (8.67%)	Singh A	124 (7.49%)	Rocco PRM	29 (8.61%)	Wiysonge CS	18 (8.96%)	Fomin V	13 (7.88%)
Wang L	380 (8.32%)	Kumar V	123 (7.43%)	Hajjar LA	26 (7.72%)	Mendelson M	17 (8.46%)	Avdeev SN	11 (6.67%)
Zhang J	347 (7.59%)	Gupta S	121 (7.31%)	Martelli H	25 (7.42%)	Moodley K	17 (8.46%)	Drosten C	11 (6.67%)

The table 3 highlights research publication pattern of BRICS countries in Corana virus in respect of top most institutions. In the observation of the table highest number of research publication output came from Chinese institutions namely Huazhong university of science technology published 2052 (18.05%) papers, followed by Chinese academy of sciences published 1676 (14.75%) papers, University of Hong Kong published 1049 (9.23%) papers and so on. highest number of research publication output came from Brazil institutions, such as Universidade de sao Paulo published 1375 (31.31%) papers, followed by Fundacao osvaldo cruz published 543 (12.37%) papers, and so on. Third highest number of research publication output came from Indian Institution, like Indian institute of technology system published 660 (19.32%) papers, followed by All India Institute of Medical Sciences published 543 (15.90%) papers, Post graduate institute of medical education research published 483 (14.14%) papers and so on. Fourth highest number of research publication output came from South Africa institutions, in that top most institution is University of cape town published 537 (20.27%) papers and Fifth highest number of research publication output came from Sechenov First Moscow StateMedicalUniversitypublished369(26.41%)papers.

All the five countries in BRICS organization are involved different research field in Corana virus during the study period. Table 4 discuss the top most contribution of each countries in research areas is mainly in health sector. Among the five countries we selected top ten highly contributed research areas based on the publication records are listed, in that each country's highest number of research field is General Internal Medicine contributed 14.49% (2049 papers) from China, followed by other top most research area are Public Environmental Occupational Health contributed 21.46% (773 papers) from Brazil, Biochemistry Molecular Biology contributed 13.29% (760 papers) from India, General Internal Medicine contributed 23.66% (380 papers) and lastly Biochemistry Molecular Biology contributed 13.86% (139 papers).

Table 5 displays the each country's top ten funding agencies in respect of Corana virus to promote the increase in research field. Ranking among the BRICS countries contribution China is the first rank followed by second is Brazil, third is India, fourth is South Africa and fifth is Russia. Total 6771 papers published by the National Natural Science Foundation of China from China, followed by 1131 papers published by the Conselho Nacional De Desenvolvimento Cientifico E Tecnologico from Brazil, 361 papers published by Department Of Science Technology India from India, 182 papers published by UK Research Innovation from South Africa and 142 papers published by Russian Foundation For Basic Research from Russia.

Table 6 indicates collaboration patterns with different countries in the world. Table depict top ten selected countries collaboration with China in the form of their publications. They contributed total 9642 papers are published together in the study period. Among that USA is the top most collaborative countries with China, i.a 3506 papers published. Further expansion of the study is observed that India is collaborative with top most countries together contribution is 5291 papers are published, in the relation with India's international collaboration USA is the most contributed among the other countries, i.a 1454 papers are published. Followed by Brazil total top ten collaboration contribution is 4760 papers are published and most collaboration with USA 1188 papers are published, South Africa total top ten collaboration contribution is 2888 papers are published and most collaboration with USA 719 papers are published and Russia total top ten collaboration contribution is 1937 papers are published and most collaboration with USA 334 papers are published.



Table 3. Top most Institutions in BRICS countries

China		Brazil		India		South Africa		Russia	
Name of Inst	Records	Name of Inst	Records	Name of Inst	Records	Name of Inst	Records	Name of Inst	Records
Huazhong university of science technology	2052 (18.05%)	Universidade de sao paulo	1375 (31.31%)	Indian institute of technology system	660 (19.32%)	University of cape town	537 (20.27%)	Sechenov first moscow state medical university	369 (26.41%)
Chinese academy of sciences	1676 (14.75%)	Fundacao oswaldo cruz	543 (12.37%)	All india institute of medical sciences	543 (15.90%)	University of witwatersrand	399 (15.06%)	Russian academy of sciences	340 (24.34%)
Wuhan university	1336 (11.75%)	Universidade federal de sao paulo unifesp	488 (11.11%)	Post graduate institute of medical education research	483 (14.14%)	Stellenbosch university	317 (11.97%)	Lomonosov moscow state university	157 (11.24%)
University of hong kong	1049 (9.23%)	Universidade federal de minas gerais	370 (8.43%)	Indian council of medical research icmr	290 (8.49%)	University of kwazulu natal	310 (11.70%)	Ministry of health of the russian federation	99 (7.09%)
Zhejiang university	936 (8.24%)	Universidade federal do rio de janeiro	363 (8.27%)	Council of scientific industrial research csir india	286 (8.37%)	University of pretoria	272 (10.27%)	Russian academy of medical sciences	87 (6.23%)
Fudan university	925 (8.145)	Universidade estadual de campinas	345 (7.86%)	National institute of technology nit system	265 (7.76%)	University of london	223 (8.42%)	South ural state university	80 (5.73%)
Chinese academy of medical sciences peking union medical college	912 (8.02%)	Universidade federal do rio grande do sul	267 (6.08%)	University of london	250 (7.32%)	University of johannesburg	186 (7.02%)	University of london	78 (5.58%)
Chinese university of hong kong	851 (7.49%)	Universidade estadual paulista	223 (5.08%)	Manipal academy of higher education	230 (6.73%)	Harvard university	153 (5.78%)	HSE university national research university higher school of economics	68 (4.87%)
Shanghai jiao tong university	828 (7.28%)	University of london	219 (4.99%)	Dr dy patil vidyapeeth pune	214 (6.26%)	South african medical research council	133 (5.02%)	Egyptian knowledge bank	60 (4.29%)
Sun yat sen university	801 (7.05%)	Universidade federal da bahia	198 (4.51%)	Department of biotechnology	195 (5.71%)	University of oxford	119 (4.49%)	Peoples friendship university of russia	59 (4.22%)

Table 4. Top most Research Area in BRICS countries

China		Brazil		India		South Africa		Russia	
Research area	Records	Research area	Records	Research area	Records	Research area	Records	Research area	Records
General Internal Medicine	2046 (14.49%)	Public Environmental Occupational Health	773 (21.46%)	Biochemistry Molecular Biology	760 (13.29%)	General Internal Medicine	380 (23.66%)	Biochemistry Molecular Biology	139 (13.86%)



Infectious Diseases	1830 (12.96%)	General Internal Medicine	672 (18.66%)	Public Environmental Occupational Health	666 (11.65%)	Public Environmental Occupational Health	291 (18.12%)	Science Technology Other Topics	123 (12.26%)
Public Environmental Occupational Health	1798 (12.73%)	Infectious Diseases	378 (10.49%)	Pharmacology Pharmacy	664 (11.61%)	Infectious Diseases	175 (10.90%)	General Internal Medicine	121 (12.06%)
Science Technology Other Topics	1474 (10.44%)	Science Technology Other Topics	317 (8.80%)	General Internal Medicine	604 (10.56%)	Science Technology Other Topics	159 (9.90%)	Environmental Sciences Ecology	109 (10.87%)
Environmental Sciences Ecology	1457 (10.32%)	Neuroscience Neurology	292 (8.11%)	Immunology	556 (9.72%)	Environmental Sciences Ecology	153 (9.53%)	Immunology	109 (10.87%)
Immunology	1417(10.04%)	Immunology	266 (7.38%)	Environmental Sciences Ecology	549 (9.60%)	Immunology	118 (7.35%)	Cardiovascular System Cardiology	102 (10.17%)
Pharmacology Pharmacy	1203 (8.52%)	Environmental Sciences Ecology	264 (7.33%)	Science Technology Other Topics	519 (9.08%)	Biochemistry Molecular Biology	97 (6.04%)	Chemistry	85 (8.47%)
Biochemistry Molecular Biology	992 (7.03%)	Cardiovascular System Cardiology	245 (6.80%)	Computer Science	501 (8.76%)	Psychology	81 (5.04%)	Psychiatry	76 (7.58%)
Research Experimental Medicine	989 (7.00%)	Psychiatry	198 (5.50%)	Chemistry	459 (8.03%)	Religion	78 (4.86%)	Public Environmental Occupational Health	71 (7.08%)
Engineering	913 (6.47%)	Tropical Medicine	197 (5.47%)	Engineering	441 (7.71%)	Business Economics	74 (4.61%)	Pharmacology Pharmacy	68 (6.78%)

Table 5. Top most Funding Agencies in BRICS countries

China		Brazil		India		South Africa		Russia	
Funding agencies	Records	Funding agencies	Records	Funding agencies	Records	Funding agencies	Records	Funding agencies	Records
National Natural Science Foundation Of China	6771 (59.17%)	Conselho Nacional De Desenvolvimento Cientifico E Tecnologico	1131 (32.27%)	Department Of Science Technology India	361 (20.92%)	UK Research Innovation	182 (16.73%)	Russian Foundation For Basic Research	142 (27.15%)
Fundamental Research Funds For The Central Universities	928 (8.11%)	Coordenacao De Aperfeicoamento De Pessoal De Nivel Superior	878 (25.05%)	Council Of Scientific Industrial Research	218 (12.63%)	United States Department Of Health Human Services	170 (15.63%)	Russian Science Foundation Rsf	77 (14.72%)
National Key Research And Development Program Of China	892 (7.80%)	Fundacao De Amparo A Pesquisa Do Estado De Sao Paulo	523 (14.92%)	Indian Council Of Medical Research	189 (10.95%)	National Institutes Of Health	161 (14.80%)	European Commission	61 (11.66%)
National Key R D Program Of China	639 (5.58%)	Fundacao Carlos Chagas Filho De Amparo A Pesquisa Do Estado Do Rio De Janeiro	219 (6.25%)	Department Of Biotechnology	183 (10.60%)	Medical Research Council	153(14.06%)	Ministry Of Science And Higher Education Of The Russian Federation	48 (9.18%)
China Postdoctoral Science Foundation	521 (4.55%)	United States Department Of Health Human Services	174 (4.96%)	University Grants Commission India	177 (10.25%)	European Commission	118 (10.85%)	United States Department Of Health Human Services	46 (8.80%)
United States Department Of Health	484 (4.23%)	National Institutes Of Health	171 (4.88%)	United States Department Of	143 (8.29%)	Well come Trust	74 (6.80%)	National Institutes Of	45 (8.60%)



Human Services				Health Human Services				Health Nih Usa	
National Institutes Of Health	469 (4.10%)	European Commission	149 (4.25%)	National Institutes Of Health	139 (8.05%)	Bill Melinda Gates Foundation	68 (6.25%)	National Natural Science Foundation Of China	28 (5.35%)
Chinese Academy Of Sciences	280 (2.45%)	UK Research Innovation	105 (3.00%)	European Commission	117 (6.78%)	CGIAR	63 (5.79%)	German Research Foundation	26 (4.97%)
National Natural Science Foundation Of Guangdong Province	246 (2.15%)	Fundacao De Amparo A Pesquisa Do Estado De Minas Gerais	86 (2.45%)	Science Engineering Research Board Serb India	110 (6.37%)	National Research Foundation South Africa	52 (4.78%)	UK Research Innovation	26 (4.97%)
European Commission	213 (1.86%)	Medical Research Council	69 (1.97%)	UK Research Innovation	89 (5.16%)	National Institute For Health Research	47 (4.32%)	Ministry Of Education And Science Russian Federation	24 (4.59%)

Table 6. Top most international collaboration in BRICS countries

China		India		Brazil		South Africa		Russia	
Countries	Records	Countries	Records	Countries	Records	Countries	Records	Countries	Records
USA	3506 (36.36%)	USA	1454 (27.48%)	USA	1188 (24.96%)	USA	719 (24.90%)	USA	334 (17.24%)
England	1433 (14.86%)	England	787 (14.87%)	England	638 (13.40%)	England	565 (19.56%)	Italy	282 (14.56%)
Australia	991 (10.28%)	Saudi Arabia	538 (10.17%)	Italy	528 (11.09%)	Australia	272 (9.42%)	Germany	242 (12.49%)
Canada	727 (7.54%)	Peoples R China	480 (9.07%)	Spain	486 (10.21%)	Canada	215 (7.44%)	England	225 (11.62%)
Germany	610 (6.33%)	Australia	475 (8.98%)	Canada	393 (8.26%)	India	212 (7.34%)	Spain	173 (8.93%)
Italy	574 (5.95%)	Italy	375 (7.09%)	Australia	339 (7.12%)	Germany	204 (7.06%)	France	170 (8.78%)
India	480 (4.98%)	Canada	321 (6.07%)	Germany	317 (6.66%)	Italy	195 (6.75%)	Peoples R China	148 (7.64%)
Pakistan	469 (4.86%)	Germany	303 (5.73%)	France	316 (6.64%)	Brazil	186 (6.44%)	India	138 (7.12%)
Singapore	438 (4.54%)	South Korea	282 (5.33%)	Portugal	279 (5.86%)	Peoples R China	162 (5.61%)	Canada	114 (5.89%)
France	414 (4.29%)	Brazil	276 (5.22%)	India	276 (5.80%)	Nigeria	158 (5.47%)	Switzerland	111 (5.73%)

In the table 7 disclose the various forms of communication channel for the exploration of research information about the Corana virus during the study period. The forms of communication channels are Articles, Review Articles, Letters, Editorial materials, Early Access, Meeting Abstracts, Corrections, Book Chapters, Data Papers and Proceedings Papers. The study findings that in all countries research contributions are published highest in Articles forms. China is published 15840 (67.28%) papers in Articles form and remaining 32.72 % is published in others 9 forms of communication channels. India is published 5274 (5034%) papers in Articles form and remaining 49.66 % is published in others 9 forms of communication channels. Brazil is published 3401 (54.78%) papers in Articles form and remaining 45.22% is published in others 9 forms of communication channels. South Africa is published 1435 (58.96%) papers in Articles form and remaining 41.04 % is published in others 9 forms of communication channels and Russia is published 963 (58.12%) papers in Articles form and remaining 41.88 % is published in others 8 forms of communication channels.



Table 7. Top most Communication Channels in BRICS countries

China		India		Brazil		South Africa		Russia	
Comm. Channel	Records	Comm. Channel	Records	Comm. Channel	Records	Comm. Channel	Records	Comm. Channel	Records
Articles	15840 (67.28%)	Articles	5274 (50.34%)	Articles	3401 (54.78%)	Articles	1435 (58.96%)	Articles	963 (58.12%)
Review Articles	2511 (10.67%)	Letters	1618 (15.445)	Review Articles	830 (13.37%)	Editorial Materials	344 (14.13%)	Review Articles	234 (14.12%)
Letters	2268 (9.63%)	Review Articles	1591 (15.19%)	Letters	717 (11.55%)	Review Articles	279 (11.46%)	Meeting Abstracts	203 (12.25%)
Early Access	1258 (5.34%)	Early Access	996 (9.51%)	Editorial Materials	583 (9.39%)	Early Access	168 (6.90%)	Early Access	82 (4.95%)
Editorial Materials	1186 (5.04%)	Editorial Materials	698 (6.66%)	Early Access	372 (5.99%)	Letters	151 (6.20%)	Editorial Materials	82 (4.95%)
Meeting Abstracts	322 (1.37%)	Meeting Abstracts	255 (2.43%)	Meeting Abstracts	251 (4.04%)	Meeting Abstracts	33 (1.36%)	Letters	79 (4.77%)
Corrections	127 (0.54%)	Corrections	30 (0.29%)	Corrections	28 (0.45%)	Book Chapters	9 (0.37%)	Corrections	10 (0.60%)
Book Chapters	14 (0.06%)	Book Chapters	7 (0.07%)	Book Chapters	17 (0.27%)	Corrections	9 (0.37%)	Data Papers	2 (0.12%)
Data Papers	10 (0.04%)	Book Reviews	5 (0.05%)	Book Reviews	6 (0.10%)	Book Reviews	4 (0.16%)	News Items	2 (0.12%)
Proceedings Papers	7 (0.03%)	Data Papers	2 (0.02%)	Data Papers	3 (0.05%)	Proceedings Papers	2 (0.08%)		

Table 8 depicts the number of citations received by research publications of BRICS countries during 2019-2021 which are also indexed in WoS. The highest number of cited research paper “Coronavirus Disease 2019-COVID-19” was received 2268 citations by Dham,K et.al from Indian contenet, followed by Coronavirus disease 2019 (COVID-19): current status and future perspectives was received 423 citations by Li, H et.al from China, Nafamostat Mesylate Blocks Activation of SARS-CoV-2: New Treatment Option for COVID-19 was received 215 citations by Hoffmann, M et.al from Russia, COVID-19: Transmission, prevention, and potential therapeutic opportunities was received 213 citations by Lotfi, M, Hamblin, M.R & Rezaei, N. from South Africa and Propolis and its potential against SARS-CoV-2 infection mechanisms and COVID-19 disease Running title: Propolis against SARS-CoV-2 infection and COVID-19 was received 55 citations by Berretta, A et.al from Brazil.

Table 8. Highly Cited Papers from BRICS Countries

Title	TC	Authors	Publisher	Countries	Year	Document Type
Coronavirus Disease 2019-COVID-19	2268	Dham,K et.al	American Society for Microbiology	India	2020	Review
Coronavirus disease 2019 (COVID-19): current status and future perspectives	423	Li, H et.al	ELSEVIER	China	2020	Article
Nafamostat Mesylate Blocks Activation of SARS-CoV-2: New Treatment Option for COVID-19	215	Hoffmann, M et.al	American Society for Microbiology	Russia	2020	Letter
COVID-19: Transmission, prevention, and potential therapeutic opportunities	213	Lotfi, M,Hamblin, M.R&Rezaei, N.	ELSEVIER	South Africa	2020	Review
Propolis and its potential against SARS-CoV-2 infection mechanisms and COVID-19 disease Running title: Propolis against SARS-CoV-2 infection and COVID-19	55	Berretta, A et.al	Elsevier France- Editions Scientifiques Medicales Elsevier	Brazil	2020	Review



6. Findings of the Study :

- ❖ The research output of BRICS countries total contribution is 41389 papers as compared with world total contribution is 195458 in the area of corona virus during the period.
- ❖ A total number of 41389 papers received 209181 citations during the period. The average citation per papers is 5.05.
- ❖ A total of 4050 collaborative papers were published during the period of 2019-2021 by the BRICS countries.
- ❖ Among BRICS countries China is leading country in the all forms of research table and in terms of highest publication data is not available in total citation, average citation per papers and H-index.
- ❖ A selected top ten authors in China they together contributed 4569 papers, followed by 1659 papers, Brazil 337 papers, South Africa 201 papers and Russia 165 papers.
- ❖ Among the institution wise China is the first rank in that highest published institution is Huazhong university of science technology i.e 2052 papers, Brazil is second rank in that highest published institution is Universidade de sao Paulo published i.e 1375 papers, India is third rank in that highest published institution is Indian institute of technology system i.e 660 papers, South Africa is fourth rank in that highest published institution is University of cape town i.e. 537 papers and Russia is fifth rank in that highest published institution is Sechenov first moscow state medical university i.e 369 papers.
- ❖ Among the research area wise China is the first rank in that highest published is General Internal Medicine i.e 2046 papers, Brazil is second rank in that highest published is Public Environmental Occupational Health i.e 773 papers, India is third rank in that highest published is Biochemistry Molecular Biology i.e 760 papers, South Africa is fourth rank in that highest published is General Internal Medicine i.e. 380 papers and Russia is fifth rank in that highest published is Biochemistry Molecular Biology i.e 139 papers.
- ❖ Among the funding agencies wise China is the first rank in that highest published is National Natural Science Foundation Of China i.e 6771 papers, Brazil is second rank in that highest published is Conselho Nacional De Desenvolvimento Cientifico E Tecnologico i.e 1131 papers, India is third rank in that highest published is Department Of Science Technology India i.e 361 papers, South Africa is fourth rank in that highest published is UK Research Innovation i.e. 182 papers and Russia is fifth rank in that highest published is Russian Foundation For Basic Research i.e 142 papers.
- ❖ Among the international collaboration wise USA is the highest collaborative country with all BRICS countries. USA's country wise collaboration with China is 3506 papers, followed by India is 1454 papers, Brazil is 1188 papers, South Africa is 719 papers and Russia is 334 papers.
- ❖ Among the communication channel wise Article is the highest communication channel in all the BRICS countries. For the study purpose selected top ten channels in all the countries but in the Russia is communicated only nine channels to published their research article on the Corana virus during the period.
- ❖ In the highly cited papers India authors received highest number of citation among the other countries authors wise, There are total 3174 citations of all five countries in that highest cited paper "Coronavirus Disease 2019-COVID-19" was received 2268 citations by Dham,K et.al from Indian continent.

7. Conclusion :

It is observed from the study that, number of COVID-19 research papers publication has been continuously increasing after its break out in the whole world. The study time line is December 2019 to December 2021. While China has topped on COVID-19 studies in various aspects as compared with other countries in term of publications records, area of interest in research field and ranks among them. This study focus on BRICS countries a better understanding of the variant innovation systems approaches and research fields authors are actively pursuing which can be used to influence future studies, collaboration and publications.

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