INDIA SEEMS TO BE BETTER PLACED IN FIGHTING AGAINST COVID-19: A REVIEW

Anita Garg Mangla¹, Neeru Dhamija¹, Priti Malhotra², Tanya Kalra³, Parthvi Mahendru³, Shreya Kandpal³ and Divyangi Dubey³

1. Assistant Professor, Department of Biochemistry, Daulat Ram College, University of Delhi, Delhi, India.
2. Associate Professor, Department of Chemistry, Daulat Ram College, University of Delhi, Delhi, India.
3. Department of Biochemistry, Daulat Ram College, University of Delhi.

Abstract

When the whole world is reeling under a severe impact of Covid 19, India which is 4 times more populous than US and many other developed nations, is not so severely hit by the epidemic. Despite India’s very low per capita income and poorly ranked healthcare system in the world, it has escaped the brunt of the pandemic. Generally epidemics exhibit exponential growth at the beginning but the initial delay and lower mortality have been ensued from many intriguing possibilities such as high geographical temperatures, high immunity due to poor hygiene, BCG vaccinations and lower average age of the population. The ongoing review presents a brief perusal of the probable causes for the initial containment of the pandemic and its potential in India.

Introduction:

COVID19 is an acronym for Corona Virus Disease of 2019 which is a disease of the virus SARS CoV2 that emerged from the city of Wuhan in China. It has now spread across different nations all over the world [1].

India is a neighboring country and shares its political borders with China, the country from where the first case of infection came to be known. There has been an endless constant battle between countries to fight against the spread of the disease and safeguard its citizens since January’2020 when the virus was first noticed by the World Health Organization (WHO) [1].

Even though India is a populous country with the second highest population in the world, it has been better in controlling the spread of Coronavirus which being highly contagious continues to be a bigger threat to India which has 17.7% of the total world population [2].

Indian government has taken all necessary steps to ensure that the country is well prepared before it's too late by providing improvement in testing kits, labs, medical facilities and building of quarantine centers as India doesn't hold a good ranking in terms of its medical facilities.

By 25th May’ 2020, the number of cases reported worldwide were 5,387,650 out of which 344,549 have died. The maximum number of cases has been reported in United States (1,642,021). Other countries after U.S. with maximum number of cases are, Brazil (363,211), Russia (344,481), United Kingdom (259,559), Spain (235,772), Italy

Corresponding Authors:- Anita Garg Mangla
Address:- Assistant Professor, Department of Biochemistry, Daulat Ram College, University of Delhi, Delhi, India.
(229,858), France (182,709), Germany (178,281), Turkey (156,827) and Iran (135,701) [data as per recorded by 25th May' 2020]. [3]

According to a study, the spread of this virus is seen lesser in countries that have earlier been hotspot of malarial infection indicating an inverse relation between the anti malaria prophylaxis and the prevention of COVID-19. Figure 1 shows the worldwide distribution of malaria and COVID-19 infection. It is suggested that this may be due to impairment of the terminal glycosylation of Angiotensin-converting enzyme2 (ACE2) receptor in pulmonary epithelial cells, when treated with chloroquine or its analog. Chloroquine is an effective drug used for treating malaria for prophylactic purposes mainly in the Sub-Saharan zones of the world. This prior treatment could have lead to reduced binding of SARS-CoV2 to its receptor and hence lesser no. of cases reported by countries that see a large number of cases of malaria every year or have been badly affected by it in the past i.e., areas with anti-malarial prophylaxis are naturally protected from COVID-19 infection. [4, 5, 6]

![Malaria and COVID-19 Distribution](image)

**Figure 1:** Distribution of malaria and COVID-19 infection in different geographical zones of the world.

Similar pattern has been seen in countries where BCG (the vaccine for tuberculosis) is administered to neonates. Countries where this vaccine is a part of their scheduled vaccines chart have seen lesser number of cases till date. But there is no concrete proof that this vaccine can prevent infection against COVID19 also. This vaccine has shown some non-specific effects on immune system in body during clinical trials. So, WHO has not yet declared it as a vaccine for use in this pandemic and continues to recommend BCG for prevention against tuberculosis. [7]

| DATE    | Number of confirmed cases |
|---------|---------------------------|
|         | USA | Brazil | Russia | UK | Spain | Italy | Germany | France | India |
| 20-Jan  | 1   | 0      | 0      | 0  | 0     | 0     | 0       | 0      | 0     |
| 27-Jan  | 5   | 0      | 0      | 0  | 0     | 0     | 0       | 0      | 3     |
| 03-Feb  | 11  | 0      | 2      | 2  | 1     | 2     | 10      | 6      | 3     |
| 10-Feb  | 12  | 0      | 2      | 8  | 2     | 3     | 14      | 11     | 3     |
| 17-Feb  | 15  | 0      | 2      | 9  | 2     | 3     | 16      | 12     | 3     |
| 24-Feb  | 53  | 0      | 2      | 13 | 2     | 229   | 16      | 12     | 3     |
| 02-Mar  | 64  | 2      | 3      | 39 | 114   | 2036  | 158     | 188    | 5     |
| 09-Mar  | 472 | 25     | 7      | 323| 1024  | 9172  | 1139    | 1402   | 44    |
| 16-Mar  | 1714| 200    | 93     | 1547| 9191  | 27980 | 6012    | 6573   | 114   |
| 23-Mar  | 31573| 904   | 438    | 5687| 28572| 59138 | 24774   | 15821  | 434   |
| 30-Mar  | 122653| 3904 | 1534   | 19526| 78797| 97689 | 57298   | 39642  | 1071  |
| 06-Apr  | 307318| 10278| 5389   | 47810| 130759| 128948| 95391   | 69607  | 4067  |
| 13-Apr  | 524514| 20727| 18328  | 84283| 166019| 156363| 123016  | 94382  | 9152  |
| 20-Apr  | 723605| 36599| 42853  | 120071| 191163| 178972| 141672  | 111463 | 17265 |
| 27-Apr  | 931698| 58509| 87147  | 152844| 207634| 197675| 155193  | 123279 | 27892 |

Table 1:- Weekly data of confirmed COVID 19 cases in nine different countries since 20th January' 2020 [8].


Graph 1:- Data of confirmed COVID-19 cases in nine different countries.

Table 1 and Graph 1 depict total confirmed cases of above 9 countries from 20th January’2020 to 24th May’2020. India, when compared to US, has 14 times less cases registered. India saw its first daily cases exceeding 1000 on 18th April’ 2020 while this rise for USA, UK and Spain was seen much earlier on, 17th March, 24th March and 13th March’ 2020 respectively.

Weekly analysis of number of cases across the world show that U.S.A., though is the most powerful country with upgraded medical facilities and lesser population density (36 per sq. km) as compared to country like India, which has a population density of 464 per sq. km, has seen largest number of deaths till date and is seeing a very large daily increase in the number of COVID cases [9].

| DATE  | Number of reported deaths |
|-------|---------------------------|
|       | USA | Brazil | Russia | UK | Spain | Italy | Germany | France | India |
| 17-Feb | 0   | 0      | 0      | 0  | 0     | 0     | 1       | 0      | 0     |
| 24-Feb | 0   | 0      | 0      | 0  | 0     | 7     | 0       | 1      | 0     |
| 02-Mar | 0   | 0      | 0      | 0  | 0     | 52    | 0       | 3      | 0     |
| 09-Mar | 19  | 0      | 3      | 28 | 463   | 2     | 30      | 0      | 0     |
| 16-Mar | 41  | 0      | 55     | 309| 2158  | 12    | 148     | 2      | 0     |
| 23-Mar | 402 | 11     | 281    | 1720| 5476  | 94    | 674     | 9      | 0     |
| 30-Mar | 2112| 114    | 1228   | 6528| 10781 | 455   | 2602    | 29     | 0     |
| 06-Apr | 5834| 432    | 45     | 4934| 12418 | 15889 | 1434    | 8064   | 109   |
| 13-Apr | 20444| 1124   | 148    | 10612| 16972 | 19901 | 2799    | 14374  | 308   |
| 20-Apr | 34203| 2347   | 361    | 16060| 20453 | 23660 | 4404    | 19689  | 543   |
| 27-Apr | 47980| 4016   | 792    | 20732| 23190 | 26644 | 5750    | 22821  | 872   |
| 04-May | 60710| 6750   | 1356   | 28446| 25264 | 28884 | 6692    | 24859  | 1373  |
| 11-May | 76916| 10627  | 2009   | 31855| 26621 | 30560 | 7417    | 26338  | 2206  |
Table 2:- Weekly data of reported deaths (cumulative) due to COVID 19 infection in nine different countries since 17\textsuperscript{th} February’ 2020. [9].

| Date   | USA   | Brazil | Russia | UK    | Spain | Italy | Germany | France | India |
|--------|-------|--------|--------|-------|-------|-------|---------|--------|-------|
| 18-May | 87180 | 15633  | 2722   | 34636 | 27650 | 31908 | 19583   | 32735  | 7935  |
| 24-May | 95863 | 22013  | 3541   | 36675 | 28678 | 32735 | 8247    | 28281  | 3867  |

Table 2 and Graph 2 depict data of deaths in 9 countries since 20\textsuperscript{th} January’2020. There were no deaths reported from 20\textsuperscript{th} January’ 2020 to 16\textsuperscript{th} February’ 2020 for these nine countries. USA has maximum deaths due to COVID, followed by UK which has 2.5 times lesser deaths than USA. As per Table 2, USA saw a sudden increase in number of deaths from 5854 to 20444 from 6\textsuperscript{th} April to 13\textsuperscript{th} April, 2020 during which India saw cases increase from 109 to 308, which is 73.3 times less than USA. India saw a large increase in the no. of deaths from 1373 to 2206 from 4\textsuperscript{th} May to 11\textsuperscript{th} May, 2020. When compared, India has 25 times less deaths than USA, and 10 times less than UK. The ratio of total registered cases to total deaths for USA is 16.61, UK is 7, Russia is 97 and India is 34.

On comparing total cases to total deaths for each country from the values illustrated in Table 1 and 2, we can see that few countries like Russia and India have a high value for this ratio, which corresponds to a lower mortality rate. India has not seen more than 200 deaths in a single day (max. deaths reported being 195 on 5\textsuperscript{th} May’ 2020) which is an indicator of how India and Indian government has been taking crucial steps in saving lives of its people. Italy ranks second in terms of medical and healthcare facilities in the world [10]. Despite that it has not been able to control the increasing cases (229327) and deaths (32735). This makes it even more important to take stricter actions for containment of the spread of disease.

The underlying graph shows the rise in cases and number of deaths reported in countries that have been hit the worst [11]. This data can be used to compare the status of spread of the disease in different geographical zones of the world:
Graph 3: The graph depicts the comparison of number of total COVID19 cases and deaths of nine different countries as per 24th May’ 2020.

Graph 3 shows total cases and deaths due to COVID-19 in 8 worst hit countries, and compares that with India: Maximum deaths were reported in US since the pandemic spread was not taken seriously in its initial phase. The stats in US are approximately 5 times the count in the country following it in total COVID cases, i.e. Brazil. USA had its first corona case on 20th January’ 2020 [12] and 10 days from that India encountered its first case. India, Spain, UK, Russia, though, saw their first cases by the end of January 2020, the total rise in the number of cases had been very fast in other countries when compared to India.

Table 3: This table shows the total cases (per 1M population), death percent and recovery percent data of nine different countries that have been hit the worst due to COVID 19 infection (data as per 25th May’ 2020). [9, 11].

| Country | Cases per 1M population | Deaths (% affected) | Recovered (% affected) |
|---------|-------------------------|---------------------|------------------------|
| USA     | 5,098                   | 5.9                 | 23.57                  |
| Brazil  | 1,719                   | 6.2                 | 40.51                  |
| Russia  | 2,422                   | 1.0                 | 29.18                  |
| UK      | 3,825                   | 14.1                | 0.053                  |
| Spain   | 6,050                   | 12.2                | 70.31                  |
| Italy   | 3,801                   | 14.3                | 59.01                  |
| Germany | 2,153                   | 4.6                 | 88.25                  |
| France  | 2,798                   | 15.5                | 35.12                  |
| India   | 102                     | 2.9                 | 40.97                  |
Graph 4: Above graph depicts the total number of cases, death (% affected) and recovered cases (% affected) of COVID-19 infection in nine different countries (data as per 25th May’ 2020). [Refer to data in Table 3].

Table 3 and Graph 4 show cases per million population and percentage of people died and recovered of the total affected population. India’s mortality rate is just 2.9% till now, with highest mortality rate being reported from France (15.5%). Russia has lowest mortality rate of 1% followed by India. For contrast Brazil, Spain, UK and Italy have a mortality rate of 6.2, 12.2, 14.1 and 14.3 % respectively. Also India has lowest cases per million (102) which is far less than that for Spain (6050), mainly due the initial lockdown in the country which was strictly implemented when cases had not even exceeded 1000. This not only helped in stopping the large increase in number of cases but also gave government time to make proper medical arrangements for future increase in cases. India, though crossed its 100,000 cases mark on 19th May’ 2020 [8], the recovery rate is 41%.

Germany tops in rate of recovery of infected patients with a huge percentile of 88.25%, while India is at a mediocre level of almost 41%. Fatality rate is highest in France amongst its affected population, followed by Italy and UK.

**Discussion:**
Low mortality rate in India can be attributed to various factors like immunity of the people prevailing there, condition of medical services provided to COVID patients and percentage of people of different age groups, for instance India having more younger population seems to have less fatality than a country having more elderly or minor population, since the COVID-19 virus is considered more lethal to people having less immunity and to the people of older age groups or children. [13]

Another reason could be the difference in temperature of different geographical zones of the world. Studies suggest that an increase in temperature and humidity reduces the stability of the virus, both in air and on different surfaces. A temperature of more than 95 degrees Fahrenheit and humidity can reduce the half life of virus on surfaces where it can live for hours to just a few minutes. This can be thought of as a reason why India and other countries of the temperate zone have not seen as many number of cases as in US or Italy. The $R_0$ value (average number of person infected by one sick person who have no immunity for the infection) is higher in places where the temperature is less-like in Northern Hemisphere- as compared to areas that are experiencing summers, as in southern hemisphere. [14, 15]
References:
1. https://www.who.int
2. Worldometers.info
3. https://infographics.channelnewsasia.com/covid-19/map.html
4. Wang, M., Cao, R., Zhang, L. et al. Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. Cell Res 30:2692712020
5. https://www.investorvillage.com/groups.asp?mb=19168&mn=260512&pt=msg&mid=20439890
6. Yao X, Ye F. Zhang et al., In vitro Antiviral Activity of Optimized Dosing design of Hydroxychloroquine for the treatment of severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Clin Infect Dis. 2020 Mar 9
7. Bacille Calmette-Guérin (BCG) vaccination and COVID-19, Scientific brief, BCG vaccines: WHO position paper – February 2018. Vaccins BCG: Note de synthèse de l’OMS – Février 2018. Wkly Epidemiol Rec. 2018;93(8):73–96. Published 2018 Feb 23, https://www.who.int/news-room/comments/detail/bacille-calmette-guerin-bcg-vaccination-and-covid-19
8. Data source: World Health Organization, Map Production: WHO Health Emergencies Programme https://covid19.who.int/region/euro/country/fr - France
https://covid19.who.int/region/amro/country/us - U.S.A.
https://covid19.who.int/region/euro/country/es - Spain
https://covid19.who.int/region/euro/country/it - Italy
https://covid19.who.int/region/euro/country/gb - The United Kingdom
https://covid19.who.int/region/euro/country/ru - Russia
https://covid19.who.int/region/amro/country/br - Brazil
https://covid19.who.int/region/euro/country/de - Germany
https://covid19.who.int/region/searo/country/in - India
9. https://www.worldometers.info/world-population/population-by-country/
10. https://www.who.int/healthinfo/paper30.pdf
11. Mortality analyses, Cases and mortality by country, Johns Hopkins University and medicine, CORONAVIRUS RESOURCE CENTER, https://coronavirus.jhu.edu/data/mortality
12. Reported Cases and Deaths by Country, Territory, or Conveyance, https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?%20#countries
13. Why India may do much better off with COVID-19, Rajender S., Polymorphism 2020.
14. Summer-like conditions can curb COVID-19 transmission: US, Aylin Woodward, High temperatures and muggy weather might make the new corona virus less contagious, a group of experts say https://news.rediff.com/commentary/2020/apr/24/summerlike-conditions-can-curb-covid19-transmission-us/38728888c9b70031ce7b1a2997dce4ac30?src=whatsapp&pos=livecomm
15. Wang, Jingyuan and Tang, Ke and Feng, Kai and Lin, Xin and Lv, Weifeng and Chen, Kun and Wang, Fei, High Temperature and High Humidity Reduce the Transmission of COVID-19 (March 9, 2020). Available at SSRN: https://ssrn.com/abstract=3551767 or http://dx.doi.org/10.2139/ssrn.3551767.