Can lifestyle factors be the key in deciding the COVID-19 outcome?

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Abstract

The COVID-19 recovery rate of 97.3% and the death per million of 345 in India are better than the corresponding values in the USA and most of Europe despite better health infrastructure in these countries. The mean COVID fatality rate of Europe and a few countries in America is seven times that of India. This warrants a systematic study of the factors behind this conspicuous disparity. It is time to study lifestyle and other factors that may be related to recovery with minimal medical intervention or serious complications, leading to belated recovery and sometimes mortality. Obesity and excessive consumption of soft drinks, red meat and processed food may have a role to play in the European and American countries. On the other hand, the use of turmeric, black pepper, ginger in daily cooking, consumption of Indian gooseberry, Tulasi, different decoctions (*Kashaya*) and practice of various immune-boosting breathing exercises including yoga might have had a role in India. A detailed study involving a sizable number of cases of recovery and death in India, USA and some European countries will throw light on these factors behind the significant differences. The results shall provide crucial learning to the world for managing future waves and pandemics.

Keywords: COVID-19, fatality, recovery rate, immunity, causative factors, diet, soft drinks, ultra-processed meat, adaptogens, sleep, lifestyle.

Introduction

The whole world has been suffering the assault of coronavirus for two years now, and the end is not yet in sight. Given that the countries with advanced medical facilities¹ have not been doing as well as some of the countries with lower per capita income, there is a need to look for other reasons such as lifestyle factors that might be behind this disparity. It appears that humanity needs to find newer ways to address such pandemics beyond merely modern medical approaches.

Table 1 lists the population and the COVID statistics² of a few countries in the American continent and about 30 countries in Europe chosen in such a way that the total population of all these countries put together is nearly the same as that of India. The statistics suggest that the recovery and fatality rates in India are better than the countries such as Belgium, France, Hungary, Italy, UK, and USA. It requires detailed studies as to what the reasons are behind India, Japan, Finland and Norway doing better in terms of lower mortality rate than USA and rest of Europe. However, Finland and Norway are small with their population being a fraction of Japan, whose population is a fraction of India's. Further, the current recovery rates in these two countries are below 21%. Thus, we mainly focus on India. Is it because most Indians eat home-cooked, rather than processed food? Is it their dependence on immune-boosting traditional herbs, medicines, *kashaya*, etc.? Is it the reduced use of recirculating air conditioners, or better sleep habits? Is it due to the lower consumption of soft drinks, refined flour and ultra-processed meat in India and Japan? In this paper, we only look for logical associations from the known scientific literature. However, a systematic research and study on these factors will be valuable to the whole of humanity and the results of the study will be useful to take steps on public health in the Covid-19 pandemic.

Some believe that COVID deaths in India are underreported. However, we must note that Dr. Anthony Fauci (Chief Medical Advisor to US President) publicly stated in May 2021

that USA has undercounted COVID fatalities and it might be 9 lakhs³. The numbers from many countries may have uncertainties.

POSSIBLE CAUSES FOR THE RESILIENCE

As of 8 January 2022, total COVID cases per million population in USA, France, and UK are 181061, 175767, and 209477, respectively, as against 25253 in India². The infection or incidence rate in these countries is 7 to 8 times that of India. The number of active cases in India is about 0.5 million, whereas it is over 17.4 million in USA. On the other hand, the population of USA of 334 million is less than one-fourth the population of India (1400 million). The number of active cases in USA is 43.3% of the total number of active cases in the world. This indicates that the turnaround of semipositive individuals in India is faster than that in the USA. The current figures correspond to recovery rates of 69.7%, 73.4%, 74.8, and 97.3% in USA, France, UK and India, respectively. The number of lives lost to COVID-19 as of 8 Jan 2022 are 2570, 2193, and 1912 per million of population in the USA, UK, and France, whereas the corresponding figure is 345 in India². The nature of medical intervention and medicines used in USA, Europe and India are comparable. Being countries ranked higher in developmental indices¹, the differences in healthcare favor these countries and not India. Hence, the differences in the incidence, recovery and fatality rates merit explanation by factors beyond the healthcare system. The following subsections discuss the possible lifestyle factors.

Consumption of soft drinks.

Mexico and the USA are countries with the highest carbonated soft drink (CSD) consumption, with Germany and Brazil coming next. Yearly consumption of CSD in the United States, Mexico, Germany and Brazil were 1496, 1489, 1221 and 537 bottles per person⁴, respectively, in 2016, as compared to 44 bottles per capita⁵ in India. The mortality rate per million population in Brazil, USA, Mexico, and Germany are 2885, 2570, 2291, and 1361 respectively, as

compared to 345 in India². Thus, there is a high correlation between the consumption of soft drinks and the COVID fatality figures in these countries. Further, the recovery rates in USA, Germany, and Mexico are less than 90%, whereas it is 97.3% in India. Of course, correlation does not imply causation; however, it is worth studying whether this could be one of the key factors. Considering the fact that not everyone in the population consume these CSDs regularly, the daily consumption of people who consume this more often must be above a litre in USA and Mexico. Most of the soft drinks available in the market are acidic with a pH around 2 to 3. Regular consumption of drinks with such acidic pH is clearly an avoidable health issue. Further, excessive consumption of sugar or sugar substitutes increases the likelihood of obesity and diabetes⁶, proven to be the greatest risk factors in COVID-19. Centre for Disease Control (CDC), USA has stated that obesity is linked to impaired immunity, decreased lung capacity, and increases the risk of hospitalization three times in the case of COVID-19 infection⁷. Adult obesity rates are very high in the United States, Mexico, and Hungary, while they are very low in Japan. As per American Diabetes Association, people with diabetes are more likely to have more severe symptoms and complications⁸ when infected with COVID-19.

Refined sugar, flour, and ultra-processed meat versus dietary fibre.

Ian Myles from the National Institute of Allergy and Infectious Diseases, USA reported in 2014 that the Western diet reduced the immunity of people⁹. A food industry analysis report¹⁰ says that fast food accounted for more than 50% of sales in the restaurant sector in 2020. There are more than 200,000 fast-food restaurants in the United States and in 2015, revenue due to fast food was \$ 200 billion in USA, which was more than one-third the fast-food revenue of the world of \$ 570 billion. Fast-food chains are less than 5% of India's food services market¹¹. This type of food is characterized by high amounts of saturated and omega-6 fatty acids, sugar and sea salt, and reduced omega-3 fat¹². The major culprit is refined sugar. When sugar is consumed, sucrose as a biomolecule needs to be broken down into glucose and fructose. The

glucose gets absorbed in the blood, but the fructose is sent to the hepatic tissues to be broken down further. The liver can manage this when provided in small amounts such as from an apple fruit; however, the abundance of this molecule present in regular processed food overwhelms liver's capability. This results in forced conversion of this extra fructose to fat which gets deposited on hepatic tissues and impairs its functioning and creates insulin resistance. Being an important innate immune organ, its damage could lead to susceptibility towards pathogens¹³. Most of the bread, cakes, donuts, muffins, and buns used in the burgers are made of refined flour and sugar, both of which have no nutrients for the body. When overconsumed, sugar is also a risk factor for osteoporosis by increasing inflammation, reducing calcium intake, and increasing urinary calcium excretion¹⁴.

A 2013 study¹⁵ has reported that the per capita consumption of lamb meat is the least in India out of a list of 44 countries, where sheep and goat meat is consumed. Greece, UK, and France have the 6th, 11th, and 14th highest consumption. Similarly, Argentina, USA, and Brazil are the countries with the second, fourth and fifth-highest per capita beef consumption, whereas India's is 52nd. High consumption of red meat is associated with higher circulating levels of gamma-glutamyltransferase and C reactive protein¹⁶, whose concentrations in blood are directly proportional to the severity of inflammation. Further, red meat contains high levels of oxymyoglobin and deoxyhemoglobin, which act as catalysts in oxidative stress and can be a basis for cancer¹⁷. Heme catalyzed oxidations can damage lipids, proteins, DNA, and other nucleic acids and various components of biological systems. A study on human-like Neu5Gc-deficient mice reported that red meat derived glycan (Neu5Gc) can initiate inflammation and cancer progression. Long-term exposure to Neu5Gc resulted in a five-fold increase in the incidence of carcinomas¹⁸. Consumption of processed meat is associated with 42% higher risk of coronary heart disease and 19% higher risk of diabetes mellitus than that of red meat. Interestingly, the USA is again in the top 10 countries consuming processed meat¹⁹. Processed

meat is even less nutritious than fresh meat due to protein oxidation²⁰ and it is also carcinogenic²¹. Thus, high consumption of red and processed meat significantly increases the co-morbidities associated with COVID-19.

In India, plant-based adaptogens are utilized as ingredients in the daily diet or as a supplement in their original form. Adaptogens have been consumed in India for thousands of years in the form of spices such as turmeric, ginger, anise, cinnamon, clove, juices such as giloy, Indian gooseberry, tulasi, and medicines such as ashwagandha, sarpagandha, and shankha-pushpi. Adaptogens have anti-inflammatory effects and help the body deal with stress. They modulate the immune response as well as detoxify and repair the compromised cells damaged from the oxidative stress of the cells induced by viruses²².

Japan has a high consumption of rice, soybean products, vegetables, fish, green tea and seasonings and a low consumption of sugars, dairy, animal fats, confectionaries and sugar-sweetened beverages. Thus, the Japanese diet is one of the healthiest in the world, and their mean life expectancy is higher than that of the Western world.

Gut microbiota and immunity

Gut bacteria in the cecum and large intestine of humans produce short-chain fatty acids (SCFAs) from indigestible plant polysaccharides (fibres) present in minimally or unprocessed food. SCFAs are important factors in regulating the metabolism of fatty acids, glucose, and cholesterol. They play a crucial role in energy metabolism²³ and immunoregulation²⁴ by epithelial barrier function, regulating proliferation and tumour suppression and inducing cytokine production. Progressive loss of good bacteria and microbial diversity in the gut has been seen as a reason for chronic diseases increasing in western countries²⁵. On the other hand, low body mass index²⁶, reduced consumption of carcinogenic components such as heterocyclic

amines, polycyclic aromatic hydrocarbons, and emulsifier²⁵ are associated with the traditional Indian diet mostly derived from plant sources. A common Indian diet is rich in phytochemicals (anthocyanin, polyphenols, alkaloids, flavonoids, carotenoids, tocopherols, reducing acids, etc.) and dietary fibres, which help in promoting diverse and stable bacterial growth and cholesterol excretion from the body, respectively²⁷. Fibres and polyphenols present in plant diet promote growth of *Lactobacillus* and other lactic acid bacteria which are anti-inflammatory, promoting cardiovascular health²⁸. Western diet has less plant-based dietary fibres and more refined flour. India and African countries use raw grains and local vegetables as essential part of their daily diet. This difference in diet selection is directly related to the flourishing gut microbiota in Indian population, providing them a possible advantage of enhanced immunity and anti-inflammatory traits.

Social factors

In India and Africa, the population is exposed to microbial load at an early age. This interaction provides an advantage of broad-based immunity. A comparative analysis of Indian and American new-borns revealed higher levels of immune-responsive cells such as dendritic cells, monocytes, natural killer (NK) cells, memory CD4 + T cells, and naïve B cells in the Indian children²⁹. Also, higher social interactions and high population density provide a continuous exchange of microbes from individuals which may act as a trigger to a more proactive cell-mediated immune system in Indians.

Sleep hygiene and immunity

Disrupted sleep and psychosocial stress cause anxiety which leads to dysregulated endocrino-immunological responses³⁰. Increase in cortisol levels, steroid insensitivity, pro-inflammatory mediators and cytokine reaction and decrease in circulating neural growth factor and brain-derived neurotrophic factor are manifestations of this disruption. This cascade

ultimately triggers a dysregulated immune response by activating “cytokine–hypothalamic–pituitary–adrenal–cytokine” axis.

Negative ions in the air, generated by water, enhance the cytotoxic activity of natural killer cells and inhibit tumour growth³¹. Negative ions have been observed to show antimicrobial properties comparable to UV light in rats and prevent tuberculosis transmission in guinea pigs³². The concentration of negative ions is higher in the air during early mornings and diminishes in late mornings and afternoon. Most Indians are early risers due to which they get exposed to negative ions which may positively impact their immunity³³. However, there is a lack of empirical studies with interaction of immune system function and negative ions.

Ventilation in houses and natural air circulation

In our earlier work³⁴, we stressed upon ventilation of the COVID ICUs in order to prevent the contaminated aerosol remaining due to the recirculation of air by the air-conditioning systems. According to CDC guidelines also, CoV-2 viral particles spread between people more readily indoors than outdoors³⁵. In the United States, 90% of the households have air-conditioning systems installed, whereas in India, it is only 5%. Hence, natural air and cross ventilation are key considerations in the construction of Indian households³⁶. In USA and other western countries, air-conditioning is an essential element in the household and offices and may have increased the transmission of infection³⁷. However, the urban areas in India have similar issues, which was reflected in the preliminary cases of COVID-19 reported in spring season of 2020.

Role of yoga, pranayama, and traditional medicine

There has been a major revival of yoga, pranayama and Ayurveda in India due to the first and second waves of coronavirus in India. Many yoga teachers prescribed specific yoga postures and pranayama techniques that activate the lymph and immune system. This yoga lifestyle is widely prevalent in India. Yoga and Tai chi are both popular in Japan, and the media

covered the elderly population practicing Tai chi during the lockdown. In India, practitioners of traditional medicine suggested home remedies in terms of decoctions made from herbs and adaptogens, which were widely followed by the public. The AYUSH department of the Ministry of Health also actively promoted Ayurvedic immunity-boosting measures for self-care. While it is difficult to gauge the exact role and effect these played in reducing the infection rate or improving the recovery rate, it is reasonable to assume that they did contribute positively.

CONCLUSION

Since the novel coronavirus has affected the whole world, we have adequate data spread out in the various hospitals of the world. All the possible factors that we have mentioned in this paper affect the human immune system as per peer-reviewed publications in good journals. There are differences between countries in health infrastructure available to public. India is still far behind in terms of health facilities and hospital availability per capita³⁸. However, the provided survey of published literature indicates the possible influence of the lifestyle factors on public health and proneness to viral infections and recovery. Thus, focused studies are required on the clinical details collected from a large number of COVID-19 hospitalized patients in India, USA, Brazil and a few European countries to get confirmed knowledge about the factors behind the differences among the COVID-19 statistics of different countries. Details such as the age, pre-existing health conditions, food habits and other lifestyle factors must be considered in the study, for a significant percentage of the active cases, recovered people, and those who did not survive the infection. The learnings from such a study will be invaluable to governments, health system administrators, and humanity as a whole to be able to manage future pandemics more effectively.

Contributors

RAG conceptualized the draft. KS did the literature search. RAG and KS jointly wrote the manuscript draft and also verified the underlying data. BNG added critical inputs and edited the manuscript. All the authors reviewed and approved the final manuscript.

Declaration of interests

We declare that there are no competing interests.

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Table 1

Comparison of COVID-19 recovery & fatality rates of Europe and America² with India and Japan as on 8 January 2022. The rank of the overall efficiency of the health system of the countries is as per WHO¹. 'NA' implies that the rank is not available. 'N/A' implies that it is not applicable.

Country	Lives lost/mil. populat	Rank of health system	Per capita Income ³⁹ in US \$	Recovery Rate %	Population in million	Total lives lost till 8 Jan 2022
India	345	112	1750	97.3	1400.6	483463
Finland	295	31	47500	15.1	5.55	1638
Norway	246	11	91500	20.5	5.49	1350
Japan	146	10	35200	98.0	125.9	18400

Bulgaria	4,582	102	8900	79.7	6.87	31,471
Bosnia	4,175	99	6180	64.6	3.25	13,568
Hungary	4,134	66	17100	88.7	9.65	39,780
N.Macedonia	3,846	89	5500	92.6	2.08	8,012
Georgia	3,559	114	4850	94.5	3.98	14,156
Croatia	3,157	43	16300	92.7	4.07	12,841
Slovakia	3,099	62	20500	93.9	5.46	16,933
Romania	3,098	99	11900	95.9	19.04	58,994
Brazil	2,884	125	11100	96.3	214.8	619,878
Lithuania	2,824	73	16000	92.6	2.66	7,524
Slovenia	2,717	38	26000	92.3	2.08	5,650

Poland	2,639	50	17400	88.3	37.8	99,720
USA	2,570	37	56200	69.7	333.9	858,346
Argentina	2,563	75	12500	97.1	45.8	117,428
Colombia	2,519	22	6200	95.2	51.7	130,250
Latvia	2,507	105	16100	93.0	1.85	4,650
Belgium	2,439	21	47400	83.0	11.67	28,459
Italy	2,299	2	34600	91.0	60.3	138,697
Mexico	2,291	61	9900	81.6	131.0	300,101
UK	2,193	18	41100	76.4	68.4	150,057
Greece	2,055	14	23200	72.6	10.3	21,263
Spain	1,922	7	32000	91.1	46.8	89,934
France	1,912	1	42600	73.4	65.5	125,206
Portugal	1,879	12	23600	92.7	10.15	19,071
Kosovo	1,608	NA	4300	97.4	1.86	2,991
Austria	1,524	9	49000	94.3	9.1	13,844
Sweden	1,504	12	58100	85.5	10.2	15,331
Serbia	1,484	NA	7100	94.7	8.7	12,890
Estonia	1,472	77	19700	91.3	1.3	1,954
Luxembourg	1,437	16	110000	86.9	0.64	922
Switzerland	1,420	20	85680	73.1	8.7	12,425
Germany	1,361	25	43800	89.5	84.2	114,586
Netherlands	1,226	17	53800	84.8	17.2	21,073
Albania	1,125	55	5200	93.5	2.9	3,233
Belarus	603	72	6700	99.0	9.4	5,699
Denmark	579	34	63500	73.7	5.8	3,371
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Mean/Total	2383	N/A		-	1309.11	3,120,308
	(maen)				(total)	(total)