

Coronavirus Pandemic

COVID-19 pandemic and “survival of the fittest”

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Abstract

Occurrence and recurrence of COVID-19 cases have been observed globally. The complex relationship of host-pathogen and the environment plays a vital role in understanding the widespread recurrence of the SARS-CoV-2 among humans. Though the pathobiology of the disease is not completely understood, it is well established that COVID-19 poses a greater threat to individuals with co-morbidities and a weakened immune system. The article deals with the notion of innate immunity, natural selection, and the survival of the fittest during the COVID-19 outbreak. The article also attempts to introduce the concept of “lifestyle and cultural immunity” that needs to be addressed and incorporated at an early stage of childhood to boost up the human immune system. The communication further discusses the role of vaccination and microorganisms pre-existing in the environment which are required to enhance the immunity of an individual.

Key words: COVID-19; SARS-CoV-2; innate and herd immunity; survival of the fittest; natural selection; essential microorganisms; vaccination; lifestyle and cultural immunity.

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Introduction

Since the beginning of the COVID-19 (Coronavirus disease 2019) pandemic, SARS-CoV-2 (Severe acute respiratory syndrome coronavirus 2) has infected about 230 million people, and caused more than 4 million deaths. As on 22nd September 2021, a total of 5 billion vaccine doses have been administered [1]. Although the primary source of this viral infection is still unknown, its genetic sequence is assumed to be similar to that of SARS-CoV-1 and MERS (Middle East respiratory syndrome). They have been seen as a product of “cross-host jump” from animals to humans depicting zoonotic nature of origin; with palm civets and camels being intermediates between bats and humans for the spread of SARS-CoV-1 and MERS respectively [2,3]. Throughout the evolutionary antiquity, *Homo sapiens* have been exposed to a plethora of pathogens. Numerous viruses have been associated with diseases of human respiratory system and central nervous system since primitive times [4], with many diseases co-evolving and existing parallel with the humans for epochs [5]. For example, human papillomavirus (HPV) co-evolved with ancestral Africans from at least 500,000 years ago [6]. While DNA viruses are known to mutate and evolve over millions of years [7], the

possibility of RNA viruses to have “human-adaptation” is considered a recent event, occurring for the last thousands of years [8]. Even though, diffusion of viruses from one species to another is not unusual, evolutionary changeover is a rare event which might happen after millions of mutations and adaptations to those viruses; and SARS-CoV-2 may be a paradigm of a successful evolutionary changeover [9].

Currently, the global disease load due to diversifying variety of pathogens that has affected humans is an amalgamation of both ancestral [10] and novel occurring or recurring infectious diseases [11], with 65% being zoonotic in origin [12]. A fraction of 24.094% of the total Indian population has been infected till date by the novel coronavirus [13]; which is far low for the assumed rate (70-90% of the population) to attain ‘herd immunity’ [14]. Initiatives by public health sectors have successfully recognised and contained emergence of SARS coronavirus, but future re-emergence remains a major concern. While developing a variety of vaccines for combating the virus is still a priority and need of the hour, yet the immune response of the human body to deadly coronaviruses plays a key role in being invulnerable to such pathogens. The literature suggests that both cell-

mediated and humoral immunity augments a long-term defence from severe deadly pathogens [15] preventing re-infection in the future.

Genetics and natural selection

It has been perceived that the novel coronavirus relies upon appropriate host cell receptors to escape the host immunity. Genetically, a major determining factor of the species specificity of coronavirus infection is the spike glycoprotein [16]. This glycoprotein initiates the infection on the coronavirus envelope and binds the virus to the ACE-2 protein on the surface of the host's cells [17] that might alter the receptor specificity in due course of time via mutation or via RNA recombination in the genes that helps in encoding the spike glycoproteins [18]. Besides this, an individual's genome sequence influences the susceptibility to infectious disease [19]. Additionally, it has been known that mutation of the glucose 6 phosphate dehydrogenase (G6PD) shows higher prevalence among African, Asian, Latin American, and Mediterranean people [20], with studies revealing the deficiency of G6PD triggering the possibility of attracting coronavirus infection that could lead to severe illness. Therefore, considering G6PD deficiency in the screening elements might help in treating the COVID-19 patients.

While natural selection also plays a pivotal role in favouring viruses to successfully transmit and proliferate the host cells [21]. Focusing on coronaviruses, they seem to occur and disappear easily through evolutionary period. The disappearance may be a result of genetic decay of viruses' genomes or large-scale extinctions of host populations [9]. Natural selection also displays geographical differences and varied responses to the common diseases such as autoimmune and metabolic disorders [22] further improving the survival and reproducibility rate amongst the human population. As an outcome, it comes down to “Survival of the fittest,” as is currently being observed in the case of SARS-CoV-2. The individuals whose immune system can combat the novel coronavirus are less affected compared to the others; thereby, achieving the innate immunity by restricting the replication of viral cells and triggering adaptive immune responses. The significance of innate and adaptive immunity in the protection against SARS-CoV-2, therefore, needs to be urgently determined.

The concept of lifestyle and cultural immunity

The manifestation of SARS-CoV-2 depends upon many viral factors (virus type, mutation, variability of the virus *in vitro*) and its interaction with individual's

immunity factors (genetics, age, gender, nutritional status, neuroendocrine-immune regulation, and physical status) [23]. Breaking the chain of transmission of SARS-CoV-2 is crucial. It is conventional that the adaptive immune responses evolved due to exposures to multiple foreign pathogens during life that may be deficient in early life. After birth, sudden exposure to various environmental factors sets off immunity to certain microorganisms. Surprisingly, specific lifestyle and cultural aspects may inculcate immunity in an individual. The essential microorganisms that are present in the mud and sand can boost up a stronger immunity at an early stage of life cycle. For example, children with high exposure to a wide variety of bacteria are less prone to develop respiratory diseases or other allergies [24]. Again, the use of ‘clean’ water with the help of reverse osmosis procedure can filter out essential microbes leading to a weaker immune system of the body making it susceptible to various diseases with age. The over-sterilization of the immediate environment may result in a defenceless immune system. Thus, overindulgence in hygiene, particularly in childhood, leads to an abrupt and sudden drop in natural exposure to all kinds of microbes [25]. Consequently, exposure of individuals to certain microbes since childhood cannot always be considered detrimental. This ‘lifestyle and cultural immunity’ can especially be seen in rural part of India and other developing countries where children are usually playing in playgrounds and develop immunity to multiple pathogens that they are exposed to. A similar assumption known as ‘hygiene hypothesis’ (‘microbial exposure’ hypothesis, or ‘microbial deprivation’ hypothesis) has also tried to uplift the awareness of the positive impact of certain microbes and their roles in regulating immune system of an individual [24,26,27]. Hence, ‘lifestyle and cultural immunity’ is a promising hypothesis to favour a lifestyle that boosts up the immunity.

Present scenario and future perspectives

Due to its evolving nature, numerous variants of SARS-CoV-2 have been observed since the COVID-19 outbreak. These evolved variants are more dangerous, serious, and more deadly than previous versions of the virus affecting the natural immunity of the individuals. The pathogenesis of these variants is still unknown to the experts, but to deal with the known pathogenesis of present variants, many national and international pharmaceutical companies have now succeeded in developing numerous vaccines (some are WHO approved while some are in the process of obtaining

approval) to fight this on-going evolving pandemic. While experts are persistently monitoring new variants of the coronavirus that cause COVID-19 to check if they spread more easily, cause more severe disease, or could have an impact on the usefulness of vaccines; some new strains of the virus, including the Delta variant, appear to be more contagious [28]. Presently, artificial immunity in the form of COVID-19 vaccination is being promoted and induced in humans. According to a CDC study, for adults previously infected with COVID-19, vaccines give better protection against re-infection than natural immunity on its own [29]. Although the possibility of herd immunity is doubtful, but epidemiologists assume that 70% of the population can be protected by vaccination or previous infection [30]. Thus, vaccination not only provides direct protection to the vaccinated people but also would be helpful in providing a safer way of controlling community transmission of COVID-19.

Conclusions

To conclude, even if numerous vaccines have been developed successfully, innate immunity still holds true as these vaccines are only successful on known variants of the coronavirus of COVID-19 but as it is evident from the evolving nature of this virus, natural immunity of the individuals plays an important role. The efficiency of the present vaccines is still debatable in case of new variants and thus innate immunity comes into play leading to survival of the fittest.

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