Brief Review:
Tropical Conditions and Outbreak of COVID-19

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ABSTRACT

Background: The new novel Coronavirus 2019 (nCOV-19 or COVID-19) has caused an unprecedented pandemic in humans. All nations have heightened their surveillances after the quick diagnosis of potential cases of the COVID-19.

Objectives: Recent statistics have mentioned that virus outbreak in tropical countries is relatively low compared to cold nations. To support this conclusion, we considered the six main tropical regions to investigate the pandemic distribution at the initial phase.

Methods: Chi-square test was applied to understand the correlation between outbreak and temperature changes. Significant probability P-value was set to $P<0.01$. P-values were calculated to both positive and death cases.

Results: Out of 1211562 infected cases, 41776 cases (3.45%) were registered at high-temperature countries ($P<0.0001$) and 1161786 cases (96.55%) at other countries like European countries or the USA. Moreover, only 1433 mortality cases (2.2%) happened, and the remaining 97.8% of mortality happened among other nations.

Conclusion: Similar to other respiratory viruses like flu and influenza, there is a low outbreak of COVID-19 in tropical nations compared to the other countries. Apart from weather conditions, it is also recommended to follow the serious preventive measures imposed by governments to survive this novel epidemic.

Introduction

Coronaviruses are a large group of viruses that can cause various diseases ranging from normal flu to severe respiratory diseases. Novel Coronavirus (n-COV) or COVID-19 is a serious ongoing pandemic that has extended in more than 185 countries. After its appearance in China, more cases were identified, and then it extended to other countries such as America, and European countries. Most of the biologists believed that this disease has originated in the wet market of Wuhan, China. Till May 20, 2020, about five million people have been infected including of 325,000 deaths.

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Many researchers and scientists are relentlessly working to develop a vaccine for this disease [1]. Meteorologists and other scholars state that this kind of viruses cannot survive in tropical or high humid conditions [2]. In support of this view, many COVID-19 infected patients have been detected in cold nations like Europe, America, etc.

Some individuals hoped that this novel coronavirus outbreak will wane as temperature rises, but pandemics often do not behave like seasonal flues or diseases. Although there is no scientific proof to explain the longevity of COVID-19 in air, the identification of a low number of new and mortality cases in tropical nations supports this issue. Some studies highlight the relationship of virus outbreaks with climate conditions [3-5]. The World Health Organization (WHO) also emphasized that only 4% of the COVID-19 outbreak has happened in tropical countries [6]. But, most biologists strongly oppose this scenario because it is hard to estimate the behavior and structure of the new coronavirus [7-9].

Likewise, recent studies support the above statements. For instance, research on virus outbreak in the USA claimed that states with Absolute Humidity (AH) of 4<AH<6 g/m^3 have experienced a significant spread compared to other states [10]. In New York, which is the worst hitting area of the USA, the average temperatures and air quality had a better correlation of the COVID-19 epidemic [8]. Similarly, in Indonesia, the weather factor triggered the spread of COVID-19 that results in its fast spread [11]. The correlation between weather and population has been observed in nine cities of Turkey and wind speed and temperature changes highly impacted COVID-19 registered cases [12].

All works mentioned that virus spread is largely associated with weather alternations. However, no proven evidence is still available in support of the suppressive role of high temperature on COVID-19. Therefore, this report presents early epidemic distribution in tropical countries and compared it with colder nations such as Europe and the USA.

Background

In 2003, because of the Severe Acute Respiratory Syndrome (SARS), many parts of the world had faced a severe outbreak [13]. The infection was caused by a novel coronavirus, which might have transmitted from wild animals like civet cats from southern China. Its genome structure, quality articulation example, and protein profiles were like those of other coronaviruses. Nevertheless, distinctive examples of a few open perusing outlines in the SARS infection genome might have added to its serious destructiveness [14].

The potential variability of the coronavirus genome may present issues in the control of future SARS epidimics. The system of SARS pathogenesis may include both direct usual cytocidal impacts on the target cells and invulnerable intervened instruments [15]. The existing pattern of the SARS infection is to a great extent unknown. In any case, in light of the similarity with different corona-

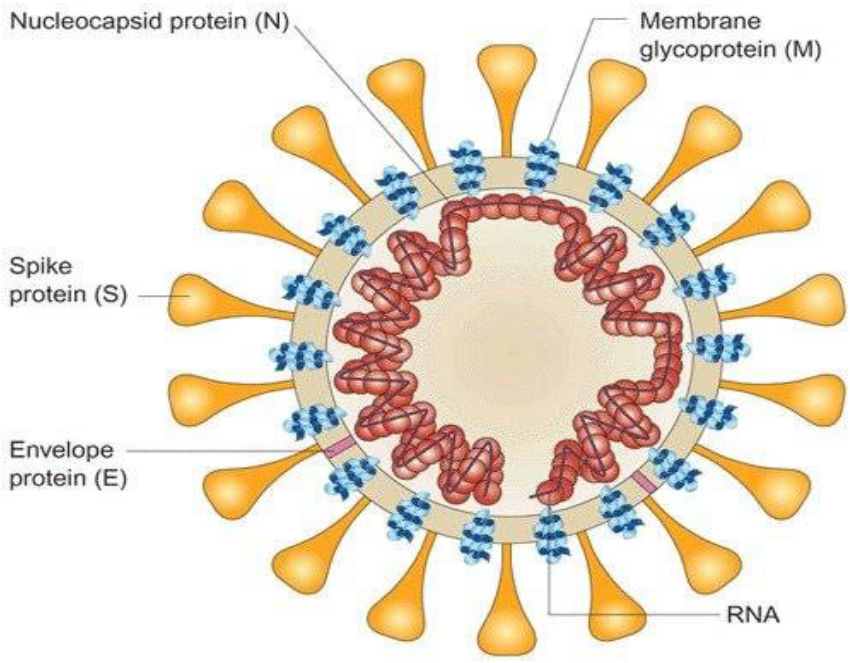

Figure 1. Genome structure of SARS virus

viruses, a few potential roads for antiviral advancement have been recognized. Immunizations offer a significant preventive measure for conceivable future repeats of SARS, yet the possibility for their advancement is obscure as a result of the vulnerability with respect to the invulnerable reactions in SARS [15, 16]. Figure 1 shows the genome structure of the SARS-CoV [17].

The coronavirus SARS-CoV-2 is the pathogen that causes COVID-19 (Figure 2). The infection has a similarity to SARS-CoV. On January 5, 2020, WHO distributed the updates on a flare-up of obscure reason . Before the end of January, WHO announced COVID-19 a general wellbeing crisis of global issue [18]. The name COVID-19 was formally called by WHO, on February 11. Precisely one month later, WHO proclaimed a pandemic. Until this date, the instances of COVID-19 have been detected in all mainland aside from Antarctica. Governments over the world have reacted with different degrees of social measures to control the spread of the infection [19-21]. As the number of cases and deaths from COVID-19 keeps on rising, scientists are attempting to find reasonable medicines and antibodies to control the pandemic.

Tropical Nations: Virus Outbreak Outcomes

The countries between the 23° latitude degrees of north and south hemispheres are called tropical countries. These nations have at least 41% of the world population. We considered early sample epidemic data till March 30, 2020, because currently, almost every global nation is facing this virus with more than five million cases that overwhelm the relationship of high temperature with COVID-19 outbreak. All registered cases are collectively retrieved from official health websites of respective countries.

Table 1 presents the relationship between temperature and registered cases of COVID-19 in tropical countries. The Chi-square test was applied to estimate the correlation between outbreak and temperature changes. A significant probability was set as $P< 0.01$. P values were calculated for both positive and death cases. The epidemic outbreak in each tropical country was almost closely related to high temperature ($P<0.0001$). According to Table 1, it is evident that an equal number of people are infected because of this virus in Latin America (15952) and South Asian (15690) nations. After that, the epidemic followed by Africa (3432), Caribbean (2546), Central America (2468), and Mexico (1688), respectively.

Figure 3 compares the outbreak between tropical and other nationalities. Out of 1211562 infected cases, 41776 cases (3.45%) were registered in countries with high temperature ($P<0.0001$) and 1161786 cases (96.55%) in other countries like European countries and the USA. Moreover, only 1433 mortality cases (2.2%) have happened, and the remaining 97.8% of mortality happened among other nations.

Based on these statistics, most researchers believe that weather changes, temperature rise, and humidity levels can defiantly influence this virus outbreak. But WHO strongly opposes this statement and believes that no clear evidence shows these tropical factors to limit the COVID-19 spread. We may also argue that based on recent statistics in May 2020, viruses have spread even in higher climate nationalities like Brazil, India, Mexico, Saudi Arabia, and the like, where the number of patients has increased by more than 300%. This proves that only imposing mitigation measures like self-isolation, social distancing, individual behavior, and increase tests could help to halt this epidemic and there is no proof that high temperature will vanish this novel outbreak [22].

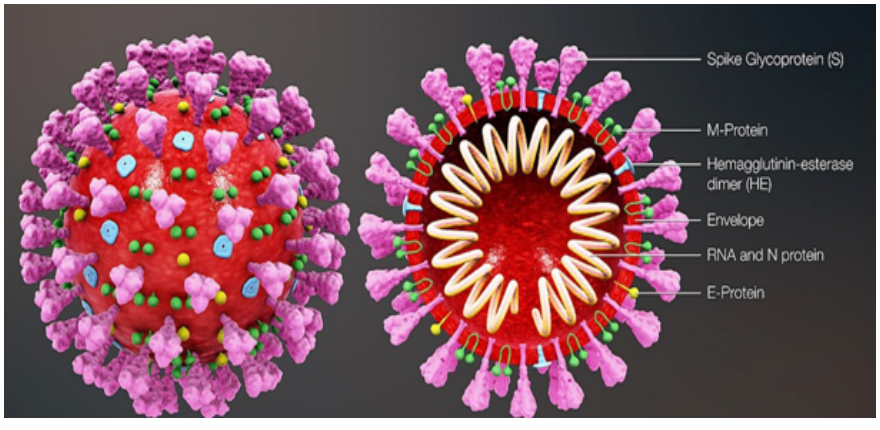

Figure 2. Genome structure of COVID-19

Table 1. Demographic values of COVID-19 outbreak in tropical countries (as of March 30, 2020)

Tropic Nationalities	Positive Cases	Deaths	Temperature	P
Latin America	15952	622	20-28°C	<0.0001
South Asia	15690	511	35-48°C	<0.0001
Africa (East, West, and Middle)	3432	88	28-34°C	<0.0001
Caribbean countries	2546	99	22-31°C	<0.0001
Central America	2468	63	20-32°C	<0.0001
Mexico	1688	60	19-25°C	<0.0001

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Established Works

COVID-19 pandemic caused tremendous health issues across the world. In [23], scholars highlighted the connection of meteorological factors with COVID-19. Study outcomes mentioned the beneficial results of epidemic changes with high humid areas, and a significant negative relationship between COVID-19 deaths and temperature surroundings just as total moistness. The impacts of diurnal temperature range and humidity should be considered while assessing the reasons for the virus spread.

Natural components can influence the epidemiological elements of numerous novel viruses. Specifically, a few investigations of atmosphere and climate conditions have found that these natural components influence the spatial spread and timing of diseases [24]. The research on climatic conditions has proved that temperature can influence flu pestilences in tropical areas. Cold regions of the Northern and Southern hemispheres experienced profoundly synchronized yearly flu pandemics throughout their winter months [25]. The regularity of flu in freeze atmosphere areas may result from the meteorological variables that can influence the ecological and physical solidness of infection particles and human social practices, the two of which add to infection of epidemiological elements.

Virus influenza is effectively low at high humid and temperature situations. In words of Australian scientist Dr. Tom Kotsimbos, any virus outbreak largely depends on local atmospheric conditions, but this new virus did not expose its complete characteristics. Therefore, it is not possible to connect the COVID-19 outbreak with tropical conditions. Besides, there is no scientific evi-

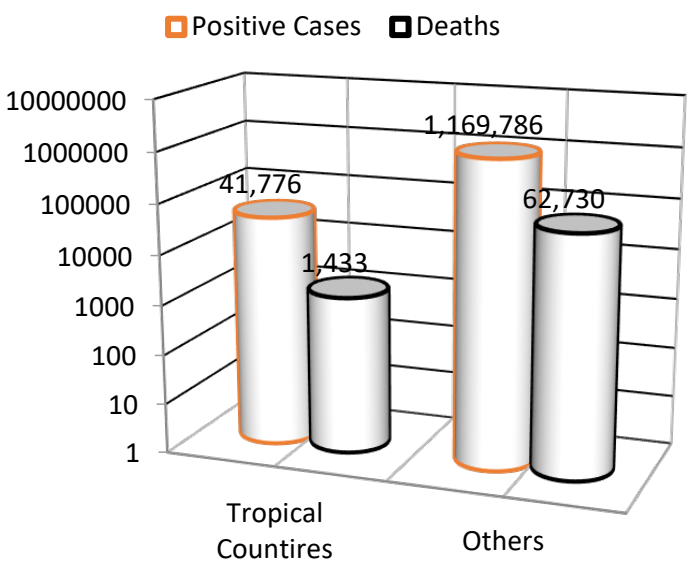

Figure 3. Comparison of COVID-19 outbreak between tropical nations and others (As of March 30, 2020)

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dence for virus spread based on tropical weather countries like pacific islands [26]. For instance in China, there is no relationship between climate and virus outbreak because this high pandemic happened during the new year festival [27].

In contrast, a study of 100 cities in China revealed that the virus outbreak was comparatively low in cities with high temperatures [28]. At the time of COVID-19 emergence in Wuhan City, the temperature and air humidity were relatively low which resulted in 2300 deaths. Later, it widely spread in America and European countries during winter. Because of the vital distribution of viruses during this period, the human immune system largely affects and causes severe virus outbreak. Some viruses even survive in tropical situations, but their resistance depends on their outer fat layer [29]. So, it is highly recommended to have proper hand wash with soap for every 20 minutes which helps to get rid of fat coatings of viruses. Irrespective of all the climate conditions, the present COVID-19 pandemic could only be controlled through government regulations and following preventive measures like self-isolation, social distancing, etc.

The COVID-19 pandemic is presently showing a considerably increased and unfavorable pattern. The future pattern of COVID-19 has drawn an extensive consideration as the northern half of the globe enters summer. This report proposes that the development pace of COVID-19 might be slow with an expansion in temperature and stickiness. Nonetheless, COVID-19 is in a phase of high infectivity and fast transmission [19]. The most recent investigation assessed that the basic Reproduction Number (R0) of COVID-19 was around 5.81 (95%CI: 3.8–8.9) [30]. Moreover, confirmed cases of COVID-19 have been accounted for in the African tropical and Amazon rainforest areas. In this way, the impact of temperature and humidity on COVID-19 transmission is not adequate to completely restrain the pandemic. Every country must take vigorous measures to control the primary pandemic and anticipate the second rise of COVID-19.

On other hand, because of fat coating layers and outside little horn genome structure, these coronaviruses are known as enveloped viruses. Similar to other enveloped viruses, they can also be melted in hot conditions [31]. In general, virus mutation can alter based on geographic location and climate conditions. Because of a similar genome structure between COVID-19 and severe respiratory acute syndrome (SARS) in 2003, researchers assume that present coronavirus could not live a long time in tropical nations [32, 33]. For instance, SARS can stay alive about 28 days at 4°C, and up to 5-8 days at 22-25°C [33, 34]. Eventually, at high temperatures, the presence of the virus would decrease which supports low COVID-19 outbreak in tropical nations.

To sum-up, further research would be expected to clarify the effect of weather conditions on the development of the COVID-19 pandemic. The presently available information on the pandemic is dependent upon a huge level of vulnerability . The quantity of affirmed cases is all around thought little of, and examinations across nations, urban areas, or locales are hard to be resolved because of contrasts in diversity information strategies or health approaches, among others.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors were equally contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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