Guest Article

CORONAVIRUS AND THE HEAT - REALISTIC PERSPECTIVE

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INTRODUCTION:

The **2019–20 coronavirus pandemic** is an ongoing pandemic of coronavirus disease 2019 (COVID19) caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV2). Severe acute respiratory syndrome coronavirus (SARS-CoV)-2, a novel coronavirus from the same family as SARS-CoV and Middle East respiratory syndrome coronavirus, has spread worldwide leading the World Health Organization to declare a pandemic. The disease caused by SARS-CoV-2, coronavirus disease 2019 (COVID-19), presents flu-likeand respiratory symptoms The outbreak was identified in Wuhan, China, in December 2019.The World Health Organization declared the outbreak a Public Health Emergency of International Concern on 30 January, and a pandemic on 11 March. As of June 12, 2020, more than 7.273 million cases of COVID-19 have been reported in 187 countries and territories, resulting in more than 413,372 deaths. More than 3.09 million people have recoveredand categorised in a high-risk disease.

Human-to-human aerosol transmission is undoubtedly the main source of contagion, which happens mainly through contaminated droplets, hands or surfaces. Virus particles, which are present in secretions from an infected person's respiratory system, infect others through direct contact with mucous membraneswith a median incubation period of between 2 and 12 days (median 5.1 days) (1).

1. ORIGIN OF CORONAVIRUS:

The most recent common ancestor of all coronaviruses is estimated to have existed as recently as 8000 BCE, although some models place the common ancestor as far back as 55 million years or more, implying long term co-evolution with bat and avian species. The most recent common ancestor of the α-coronavirus line has been placed at about 2400 BCE, of the β-coronavirus line at 3300 BCE, of the -coronavirus line at 2800 BCE, and of the -coronavirus line at about 3000 BCE. Bats and birds, as warm-blooded flying vertebrates, are an ideal natural reservoir for the coronavirus (2).

MERS-CoV emerged in humans from bats through the intermediate host of camels. MERS-CoV, although related to several bat coronavirus species, appears to have diverged from these several centuries ago. The most closely related bat coronavirus and SARS-CoV diverged in 1986. The ancestors of SARS-CoV first infected leaf-nose bats of the genus *Hipposideridae*; subsequently, they spread to horseshoe bats in the species *Rhinolophidae*, then to civets, and finally to humans(2).

The emerging coronavirus disease (COVID-19) has swept across the world, and this outbreak was reported in Wuhan, China affecting more than 200 countries and territories. On 31st December 2019, the outbreak was traced to a novel strain of coronavirus, which was given the name 2019-nCoV by the World Health Organization (WHO), later renamed as SARS-CoV-2 by the International Committee on Taxonomy of Viruses. Genomic analysis suggests that the COVID-19 virus originated in bats and transmitted to humans through unknown intermediate hosts in the Wuhan seafood market, China, in December of 2019.

TYPES OF CORONAVIRUS:

The term 'coronavirus' refers to a large group of viruses known to affect the birds and mammals, including humans. COVID-19, which first appeared in China in December 2019, is a type of coronavirus. There are hundreds of coronavirus, but only seven types are known to affect the people. Four human coronavirus only cause mild cold or flu-like symptoms. Three other coronaviruses can cause more serious risks. The seven coronaviruses that affect the humans can be categorized into two groups:

i) Common human coronavirus

There are four common human coronaviruses namely 229E, NL63, OC43, HKU1. Common human coronaviruses usually cause mild to moderate symptoms. Most people around the world will develop at least one of these viral infections over their lifetime. Those who develop these kind of infections recover on their own most of the time.

ii) Other human coronavirus

There are three other human coronavirus-

1. **SARS-CoV-** SARS-CoV causes Severe Acute Respiratory Syndrome (SARS). This virus is said to have originated in bats and are transmitted to other animals before infecting humans.

2. **MERS-CoV-** MERS-CoV causes Middle East Respiratory Syndrome (MERS). This virus is spread through the contact with the camels that have carried the infection.

3. **SARS-CoV-2-** SARS-CoV-2 causes the illness known as COVID-19. This new coronavirus appeared in Wuhan, China, in late December 2019. Though the virus likely evolved from an animal source, its exact source is unknown. This virus is dangerous because it is transmitted easily from person-to-person, whether or not the person is exhibiting symptoms (3).

2. INFECTIVE STATUS OF DIFFERENT STRAINS:

Six species of human coronaviruses are known, with one species subdivided into two different strains, making seven strains of human coronaviruses altogether. Four of these coronaviruses continually circulate in the human population and produce the generally mild symptoms of the common cold in adults and children worldwide: -OC43, -HKU1, HCoV-229E, -NL63.

These coronaviruses cause about 15% of common colds, while 40 to 50% of colds are caused by rhinoviruses. The four mild coronaviruses have a seasonal incidence occurring in the winter months in temperate climates. There is no preference towards a particular season in tropical climates.

Four human coronaviruses produce symptoms that are generally mild: 1. Human coronavirus OC43 (HCoV-OC43), β-CoV. 2. Human coronavirus HKU1 (HCoV-HKU1), β-Co. 3. Human coronavirus 229E (HCoV-229E), α-CoV. 4. Human coronavirus

NL63 (HCoV-NL63), α-CoV

Three human coronaviruses produce symptoms that are potentially severe: 1. Middle East respiratory syndrome-related coronavirus (MERS-CoV), β-CoV. 2. Severe acute respiratory syndrome coronavirus (SARS-CoV), β-CoV.3. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), β-CoV (2).

The SARS-CoV-2 is a coronavirus, which is enveloped, non-segmented positive-sense RNA virus. Coronaviruses are divided into four genera, including α, β,-CoV. α and β-CoV infect the mammals, while -CoV tend to infect the birds. Six CoV's have been identified as human-susceptible virus, among which α-CoVs (HCoV-229E and HCoV-NL63) and β-CoVs (HCoV-HKU1 and HCoV-OC43) with low pathogenicity, cause mild respiratory symptoms similar to a cold. The SARS-CoV and MERS-CoV lead to severe and potentially fatal respiratory tract infections. It was found that the genome sequence of SARS-CoV-2 is 96.2% identical to a bat CoV RaTG13, whereas it shares 79.5% identity to SARS-CoV (1).

A recent study that was reportedly done at the National Institute of Biomedical Genomics, West Bengal suggested that there are at least 11 different strains of SARS-CoV-2 in the world. A strain is a subtype of a virus that is created due to a mutation in the genome (genes) of the said virus. For the study, scientists at the National Institute of Biomedical Genomics studied more than 3,600 samples of the SARS-CoV-2 genome collected from various countries (around 55) of the world. These samples were then studied to look for similarities and differences. As per the study, the original strain of the COVID-19 causing virus was named O type or ancestral type. But from this strain at least 10 different strains had originated. Out of these 10 new strains, a strain called A2a is currently the most prevalent in the world as well as in India. The study claims that if a vaccine is to be made, it should be made against A2a strain.The A2a strain reportedly has an advantage over its peers in that it can better bind with the ACE-2 receptors in the lungs which is what the SARS-CoV-2 virus uses to enter into healthy cells. This happens due to a change in a single amino acid from aspartic acid to glycine in the spike protein of the virus. The stronger this virus binds to its receptors the more chances of it entering a healthy cell and replicating.

3. VIRULENCE OF CORONAVIRUS:

The common human CoVs are generally associated with relatively mild clinical symptoms and cause a self-limiting upper respiratory tract disease. Several independent research groups have identified that SARS-CoV-2 belongs to β-coronavirus, with highly identical genome to bat coronavirus, pointing to bat as the natural host. The novel coronavirus uses the same receptor, angiotensin-converting enzyme 2 (ACE2) as that for SARS-CoV, and mainly spreads through the respiratory tract. The clinical symptoms of COVID-19 patients include fever, cough, fatigue and a small population of patients appeared gastrointestinal infection symptoms. The elderly and people with underlying diseases are susceptible to infection and prone to serious outcomes, which may be associated with acute respiratory distress syndrome (ARDS) and cytokine storm.

The virulence nature of this coronavirus vary significantly in risk factor and are as follows:

1. Symptoms of COVID-19 (SARS-CoV-2 syndrome) may occur within 2–14 days after exposure and can lead to difficulties in cilium beating of airway cells and to alveolar damage. 2. Infected patients experience mild to severe manifestations, such as fever, dry cough, dyspnoea, abdominal pain, and diarrhoea. 3. Can cause pneumonia and bronchitis. 4. Affects both upper and lower respiratory tracts. 5. Attacks artery walls and can cause organ failure. 6. Strokes and heart damage.7. Severe urinary complications and acute kidney injury.8. Skin lesions, neurological problems, sharp chest pains, loss of taste and smell.

4. GENETICS OF CORONAVIRUS:

Coronaviruses are large, enveloped RNA viruses of both medical and veterinary importance. At the mo-

lecular level, coronaviruses employ a variety of unusual strategies to accomplish a complex program of gene expression. Coronavirus replication entails ribosome frame shifting during genome translation, the synthesis of both genomic and multiple subgenomic RNA species, and the assembly of progeny virions by a pathway that is unique among enveloped RNA viruses. Progress in the investigation of these processes has been enhanced by the development of reverse genetic systems, an advance that was obstructed by the enormous size of the coronavirus genome.

A new genetic analysis of 10 genome sequences of 2019-nCoV in Wuhan found that the virus was most closely related to two bat-derived SARS-like coronaviruses. Comparing the 2019-nCoV genetic sequence with a library of viruses, a team of researchers from the China found that the most closely related viruses were two SARS-like coronaviruses of bat origin bat-SL-CoVZC45 and bat-SL-CoVZXC21 which shared 88% of the genetic sequence. The scientists found 2019-nCoV was genetically little distant to the human SARS virus (which shared about 79% of the genetic sequence) and the Middle East respiratory syndrome (MERS) virus (which shared about 50% of the genetic sequence).

SYMPTOMS OF COVID-19:

The primary symptoms of COVID-19 include: 1. Cough 2. Fever3. Shortness of breath 4. Fatigue

Less common symptoms of COVID-19 include:1. Sore throat 2. Nasal congestion 3. Muscle aches and pains 4. Diarrhoea 5. Loss of taste or smell 6. Headache 7. Chills, which may occur sometimes with repeated shaking (3).

PRECAUTIONS FOR COVID-19:

The following basic protective measures can help you protect yourself from COVID-19:

1. Stay home. The best way to protect yourself from the virus is to avoid being exposed to it. That means staying home to avoid coming into contact with people who might have the virus.

2. Wash your hands often and thoroughly. Wash your hands with soap and water for at least 20 seconds especially if you have been in a public area.

3. Use an alcohol-based hand sanitizer. When it's not possible to wash your hands, use a hand sanitizer with at least 60 percent alcohol content.

4. Avoid touching your face. The virus can survive on surfaces that you touch with your hands. If your hands come into contact with your mouth, nose, and eyes, the virus might enter your body.

5. Practice social distancing. If you need to leave your house, maintain your distance from anyone who might have the virus, especially if the virus is being transmitted in your community.

6. Seek regular updates. The situation is evolving rapidly. It's important to follow instructions from public health officials (3).

The virus is primarily spread between people during close contact, often via small droplets produced by coughing, sneezing, or talking. The droplets usually fall to the ground or onto surfaces rather than remaining in the air over long distances. People may also become infected by touching a contaminated surface and then touching their face.On surfaces, the amount of virus declines over time until it is insufficient to remain infectious, but it may be detected for hours or days.It is most contagious during the first three days after the onset of symptoms, although spread may be possible before symptoms appear and in later stages of theCommon symptoms include fever, cough, fatigue, shortness of breath, and loss of smell. Complications may include pneumonia and acute respiratory distress syndrome. The time from exposure to onset of symptoms is typically around five days, but may range from two to fourteen days.There is no known vaccine or specific antiviral treatment for this pandemic as of now. Primary treatment is symptomatic and supportive therapy.

Recommended preventive measures include hand washing, covering one's mouth when coughing, maintaining distance from other people, wearing a face mask in public settings, and monitoring and self-isolation for people who suspect they are infected. Authorities worldwide have responded by implementing travel restrictions, quarantines, curfews and stay-at-home orders, workplace hazard controls, and facility closures. Many places have also worked to increase testing capacity and trace contacts of infected persons.

HIGH TEMPERATURES INEFFECTIVE AGAINST CORONAVIRUS

The novel coronavirus can survive in high temperatures, researchers said, casting doubt on suggestions that the threat will subside in the summer. Researchers from the University of Aix-Marseille in France, led by Remi Charrel and Boris Pastorino, found that the virus survived in **140-degree Fahrenheit temperatures** typically used to disinfect research labs, The Jerusalem Post reported.

It took **15 minutes** of exposure to **197.6-degree temperatures** to kill the virus, the newspaper noted, adding that the study had yet to be peer-reviewed. Researchers did say the lower temperature should be sufficient to deactivate the virus in samples with smaller loads but added that the higher temperature was necessary for larger loads and concluded that disinfecting chemicals were a better option.Earlier research has reached similar conclusions.

A National Academies of Sciences (NAS) panel has told the White House in early April that previous research suggesting a connection between temperature and the virus's transmissibility was flawed. "There is some evidence to suggest that [the coronavirus] may transmit less efficiently in environments with higher ambient temperature and humidity; however, given the lack of host immunity globally, this reduction in transmission efficiency may not lead to a significant reduction in disease spread" without efforts such as social distancing, the NAS report stated, noting that SARS and MERS are not seasonal (4).

THE VIRUS DOES SEEM TO DIE FASTER IN SUNNIER, HOTTER, AND MORE HUMID LAB CONDITIONS

A handful of lab experiments in China and the United States suggest the coronavirus decays more quickly in summer versus winter conditions.Researchers in Hong Kong found that when a sample of the coronavirus in a cell culture was left at **39 degrees Fahrenheit**, it was still detectable after 14 days; at **71 degrees**, the virus degraded significantly over 7 days and was not detectable after 14 days. And when exposed to **98 degrees**, no virus was detectable by the second day, according to results published April 2 in the Lancet.

The preliminary DHS study announced similar findings though the agency did not release its methodology or raw data. The experiment exposed virus in droplets of simulated saliva on a stainless steel surface to different levels of solar radiation to simulate sunlight, as well as a range of temperatures and humidities. Under the **70 to 75 degree Fahrenheit** temperature range, with 20% humidity, the virus decayed by half over 18 hours; when humidity was increased to 80%, the virus decayed by half in only 6 hours. When the temperature was increased to **95 degrees**-Fahrenheit combined with the higher humidity, the virus half-life again dropped to 1 hour. And the virus rapidly decayed in 2 minutes when exposed to **75 degrees Fahrenheit**, 80% humidity, and intense solar radiation used to simulate sunlight.

SUNLIGHT, HUMIDITY DAMAGES NOVEL CORONAVIRUS, SAYS THE WHITE HOUSE

The coronavirus outbreak in the US has killed many Americans and has infected more than the death rate. The most striking observation to date is the powerful effect that solar light appears to have on killing the virus, both on surfaces and in the air. The similar effect is seen with both temperature and humidity as well. Increasing the temperature and humidity, or both, is generally less favourable to the virus. In a room at **70-75ºF (21-23ºC) temperature** with 20 percent humidity, the half-life of the virus is about an hour according to the study.But you get outside and

Increased temperature, humidity, and sunlight are detrimental to SARS-CoV-2 in saliva droplets on surfaces and in the air.				
CONDITION	**Temperature**	**Humidity**	**Solar**	**Half Life**
Surface	70-75˚F	20%	None	18 hours
Surface	70-75˚F	80%	None	6 hours
Surface	95˚F	80%	None	1 hour
Surface	70-75˚F	80%	Summer	2 minutes
Aerosol	70-75˚F	20%	None	˜60 minutes
Aerosol	70-75˚F	20%	Summer	˜1.5 minutes

it cuts down to a minute and a half, very significant difference when it when it gets hit with UV rays.

According to the same research, the virushalf-life on surfaces reduces dramatically with a combination increase of temperature and humidity. When the temperate is kept constant at **70-75ºF (21-23ºC)** and only the humidity is cranked up from 20 percent to 80 percent, the virus half-life is shown to crash from 18 hours to 6 hours. If the temperature is increased to **95ºF (35ºC),** the half-life sinks to barely 60 minutes (5).

EXPOSING YOURSELF TO THE SUN WON'T ELIMINATE CORONAVIRUS

Hot temperatures even those above **75 degrees**don't have an effect on the virus, and no area of the country has less of a risk than others right now because of its climate.

"You can catch COVID-19, no matter how sunny or hot the weather is. Countries with hot weather have reported cases of COVID-19," according to the World Health Organization.

"To protect yourself, make sure you clean your hands frequently and thoroughly and avoid touching your eyes, mouth and nose." (6).

COVID-19 CAN ALSO SPREAD IN HOT AND HUMID CLIMATES

There's still a question of seasonality with COVID-19. Early on in the outbreak, experts suspected the virus could be like other coronaviruses and have a shorter lifespan at higher temperatures and in higher humidity.

Most illnesses have an easier time surviving and reproducing in the colder months. But we won't know for sure this will happen with COVID-19 until the seasons change and more research comes."We don't have direct data for this virus, nor do we have direct data for a temperature-based cut off for inactivation at this point," according to the Centres for Disease Control and Prevention. "The necessary temperature would also be based on the materials of the surface, the environment, etc."(6).

COLD WEATHER ALSO CANNOT KILL CORONAVIRUS

There also isn't evidence that an extreme cold outside temperature will have an effect on the virus. WHO that there is "no reason to believe that cold weather can kill the new coronavirus or other diseases." Our normal body temperature typically remains around 98 degrees, give or take, regardless of the external temperature or weather (6).

DIRECT EXPOSURE TO INTENSE TEMPERATURES THROUGH OTHER METHODS WILL ALSO NOT ELIMINATE COVID-19

Hand dryers, hot baths, ice baths, UV lights and other related methods will likely not prevent a COVID-19 infection on their own.

WHO warns that attempting these methods may end up being harmful. For example, extremely hot showers can burn you, and UV radiation can cause skin irritation (6).

CONCLUSION:

From these information's we come to know that the novel coronavirus can survive in both the high and low temperatures. More researches need to be carried out upon this for a clear view of this virus being spread in hot, humid or cold conditions with respect to different environmental conditions. So, from this we come to know that neither the hot temperature nor the cold temperature can kill the virus.

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