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ABSTRACT

This paper provides a review of studies on coronavirus (COVID-19) and its transmission. Now it is necessary to understate the previous studies on the coronavirus to understand its dynamics and linkage with the backgr ound meteorological parameters. In our review, we found that the COVID-19 has a significant relationship w ith meteorological parameters such as temperature and humidity. The ideal temperature range for COVID-19 survival is 13- 24 °C, among which 19°C conductive and it can last about 60 days. However, the 50%-80% relative humidity range is ideal for the survival of COVID-19. The rainfall also influences the lifecycle of C OVID19, the favorable precipitation range is below 30 mm/ month. The spread of SARS-CoV-1 has been ob served a minimum impact of atmospheric aerosols but in the case of COVID-19. It can be transported by a hi gh aerosol concentration in a confined space so further detailed investigation on COVID-19 and atmospheric aerosols/ pollution are required. The life of COVID-19 is also influenced by the available material surface f or deposition.

Keywords: *COVID-19, Meteorological parameters, Aerosols, etc.*

INTRODUCTION

Novel Corona Virus also named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It is closely related to the family of previously known SARS virus. Scientists stated that it is originated in the species of bats. Now, it is in humans and spreading through human to human transmission or by the contact of any contaminated surface (Lu et al., 2020).

Currently, there is no evidence to suggest that many animals, including pets, livestock, or wildlife, might be a source of COVID-19 infection at this time. However, because all animals can carry germs that can make people sick, it's always a good idea to practice healthy habits around pets and other animals.

Its size is about 120 nm which lies in the size range of accumulation range of aerosols. It is released in the atmosphere generally by sneezing or coughing by an infected person. Which after emission can deposit on other aerosols and remain in the air up to half-hour its lifetime on the different surface varies from several hours to few days (Fehr et al., 2015).

LITERATURE REVIEW

A study published (van, et al., 2020) in the New England Journal of Medicine gives the experimental outcomes of surface stability of SARS-CoV-2 and SARS-CoV-1 the most closely related human coronavirus. It reduced considerably on aerosols within a period of 3 hours and it was found to be more stable on plastic and stainless steel (detected up to 72 hours).

Dr. Linsey Marr is an expert in the transmission of viruses by aerosol at Virginia Tech in Blacksburg. Dr. Marr commented on the nature of the coronavirus and outcomes of the above study that, based on physics, an aerosol released at a height of about 6 feet would fall to the ground after 34 minutes. The findings should not cause the general public to panic, however, because the virus disperses quickly in the air.

She said, the researchers used a relative humidity of 65%. "Many, but not all viruses, have shown that they survive worst at this level of humidity," she said. They do best at lower or much higher humidity. The humidity in a heated house is less than 40%, "at which the virus might survive even longer". Whereas

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study by Bu et al., (2020) found that the suitable temperature range for 2019-nCoV survival is (13- 24 °C), among which 19°C lasting about 60 days is conducive to the spread between the vector and humans; the humidity range is 50%-80%, of which about 75% humidity is conducive to the survival of the coronavirus; the suitable precipitation range is below 30 mm/ month. Cold air and continuous low temperature over one week are helpful for the elimination of the virus.

To assess the ability of the virus to survive in the air, the researchers created what Munster described as "bizarre experiments done under very ideal controllable experimental conditions." They used a rotating drum to suspend the aerosols and provide temperature and humidity levels that closely mimic hospital conditions.

Munster noted that, overall, the new coronavirus seems no more capable of surviving for long periods than its close cousins SARS and MERS, which caused previous epidemics.

Other experts said the paper's findings illustrate the urgent need for more information about the virus's ability to survive in aerosols and under different conditions.

A well define studies on meteorological parameters by Bukhari et al., (2020) observed that the 90% of the Coronavirus (2019-nCoV/ COVID-19) cases have been recorded in the non-tropical countries (30N and above such as some part of China, European countries and the US,) within a temperature range of 3 to 17C. Similarly, 90% of the cases were observed within the countries with absolute humidity (AH) between 3 and 9g/m3. Several countries between 30N and 30S such as Australia, UAE, Qatar, Singapore, Bahrain, Qatar, and Taiwan have performed extensive testing per capita and the number of positive 2019-nCoV cases per capita is lower in these countries compared to several European countries and the US. According to this study, the lower number of cases in tropical countries might be due to warm-humid conditions, under which the spread of the virus might be slower as has been observed for other viruses.

Cai et al., (2007) observed that in univariate analyses, daily average temperature (DAT), daily average air pressure (DAAP), and daily average relative humidity (DARH) were foud inversely associated with an attack rate of SARS-CoV-1 ($P < 0.001$); a significant positive association was also found for daily hours of sunshine (DHS) ($P<0.001$) as well as he also suggest to performed more detailed studies on the impact of Aerosol and meteorological parameters on COVID-19. So it is very interesting to observe the impact of pollution on COVID-19 in future studies.

Singh (The Hindu March 24, 2020), mentioned that Chinese authorities think that there could be a possible aerosol transmission in confined spaces with prolonged exposure to high concentrations of aerosols.

SARS-CoV-2 survives for no more than a day on cardboard and about two to three days on steel and plastic. These viruses don't endure in the world. They need bodies. A previous study (Cox, 1989) suggests that various types of viruses can change their properties due to temperature and humidity. Radiation, oxygen, ozone, and its reaction products and various pollutants also decrease viability and infectivity through chemical, physical, and biological modification.

Although, WHO claims that coronavirus is not an air-borne disease but the recent study suggests that it can sustain in the air up to 30 min. Its deposition on the pollutants and aerosols could lead to its transmission through the air. The impact of aerosol concentration on the transmission of the virus can be analyzed by the study of aerosol concentration and recorded cases of coronavirus among humans.

But it has been shown that another coronavirus, the Severe acute respiratory syndrome coronavirus) SARS-CoV, was able to survive for 24 hours outside of the body (CDC, 2020), so at this time similar assumptions were used by Zucco et al., (2020) regarding the 2019-nCoV.

CONCLUSION

Apart from the impact of temperature and humidit y several other factors including transport and travel, s ocial contact, health and safety measures, age factor, a nd government policies to prevent the community spr ead of COVID 19. More precise data on the confirme d case of the virus among the population across the co untry will be helpful to estimate the impact of weather conditions on the viability and effectivity of the virus. In our review on coronavirus, meteorological paramet ers, and aerosol we conclude the following facts:

- Coronavirus (COVID-19) has a potent relationship with meteorological parameters such as temperature and humidity; the suitable temperature range for 2019-nCoV survival is (13-

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24 °C), among which 19°C lasting about 60 days, whereas the Humidity 50%-80%, is ideal for the survival of COVID19.

- Rainfall also impacts the survival of COVID-19; the ideal suitable precipitation range is below 30 mm/ month.
- The Spread of SARS-CoV-1 has been observed a minimum impact of Atmospheric aerosols but in the case COVID-19 some experts believed that it can transport by a high aerosol concentration in a confined space; it required further we define detailed investigation on COVID-19 and Atmospheric Aerosols/ pollution.
- The life of COVID-19 influenced by the available surface of the material of the for deposition and its properties can be changed as per available environments such as meteorological parameters and chemical composition of pollutants/ Aerosols for chemical and physical modifications.

FUTURE PLAN

Based on the review of the studies on coronavirus we are suggesting the following plans:

- A few numbers of studies have performed to analyze the impact of Pollutants on both SARS-CoV-2 and SARS-CoV-1. So a relationship can be established between meteorological parameters, Aerosols, and SARS-CoV-2 over the Indian subcontinent by using univariate and multivariate regression.
- Many experts believe that COVID-19 is not an airborne disease but it can infect more people in confined space with high Aerosol (pollutants) loading/ concentration. These conditions are expected to fulfill for densely populated and highly polluted locations such as New Delhi, Kanpur, Kolkata, Mumbai, Noida, Ghaziabad, Bareilly, Allahabad, Moradabad, and Firozabad (economics times).
- Weather forecast models (European Centre for Medium-Range Weather Forecast, ECMWF 9 Km) will be very helpful to estimate the ideal range of temperature, humidity zones, and period for COVID-19 across India. These zones and periods will be helpful for relief hour during lockdown due to COVID-19. **(Table 1 and Figure 1).**

	Conditions			Comfort	
Time		**Temp**	**Weather**	**Wind**	**Humidity**
08:30 Mon, 30 Mar		20 °C	Sunny.	11 km/h ↑	75%
05:30		17 °C	Fog.	4 km/h ↑	88%
02:30		20 °C	Fog.	4 km/h ↑	80%
23:30 Sun, 29 Mar		22 °C	Clear.	4 km/h ↑	69%
20:30		24 °C	Clear.	4 km/h ↑	60%
17:30		29 °C	Sunny.	11 km/h ↑	38%
14:30		30 °C	Sunny.	19 km/h ↑	34%
11:30		27 °C	Sunny.	15 km/h ↑	42%

Table 1: New Delhi Weather details on 30 March 2020

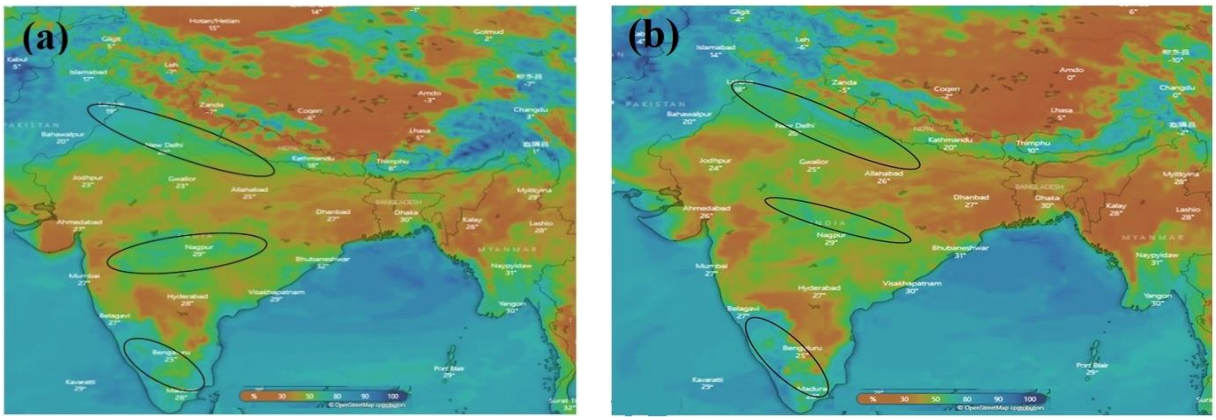

Figure 1: Spatial variation of Temperature (◦C) and Humidity (%); (a) 30 March 2020 at 9 AM and (b) 30 March 2020 over the Indian continent (humidity is represented by color map at the corresponding temperature at different locations. Ideal Zones are enclosed by the black ellipse. https://www.windy.com/-Humidity-rh?rh,2020-03-31-03,23.120,90.571,5

Figure 1 gives us a spatial approximation of Surface air Temperature and Humidity over different ideal zones over the Indian continent, which are found suitable for the survival of coronavirus on 30 March 2020 and 31 March 2020. This spatial map is poted by using European Centre for Medium-Range Weather Forecast, (ECMWF 9 Km) Model, which suggest that 1st- ideal Zones (Temperature; 13- 24 °C and Humidity 50% to 80%) are located over Delhi, Punjab, Haryana Most of the part of Uttar Pradesh. The 2nd ideal zone is located over some part of Maharastra and Madhya Pardesh, whereas 3rd ideal zone is situated over Kerala, Karnataka, and Tamilnadu. All these ideal Zones are suffering from a higher number

of cases of coronavirus in the current situation. Similarly ideal period for survival of at new Delhi is represented by a red color rectangle (table 1). https://www.timeanddate.com/weather/india/new-delhi/historic

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