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Environment Stability of Viruses Outside Host Environment - A Review

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Abstract: *The review talks on the SARS coronavirus, influenza virus, and ebola virus's abilities to survive outside of their host environments. A clinically unwell person or a carrier can transmit a virus into the environment, and the virus can then persist for a while outside the host without reproducing. biotic and biotic environmental elements both play a role in the virus's transmission, dissemination, and infection. We can better manage epidemics and pandemics if we have an understanding of viral stability outside of the host environment.*

I. INTRODUCTION

Environmental factors, the environment, and infectious diseasesHuman health is highly influenced by the environment and its components. Environment is the result of biotic and abiotic forces working together. The term "biotic factors" refers to the biological components of the environment, such as people, plants, animals, microorganisms, etc. Abiotic factors include nonliving elements like sunshine, temperature, and climatic conditions. Animals, plants, fungi, microorganisms, viruses, and other living things all coexist on planet earth and are interconnected. This food web helps to maintain the environment's energy flow and nutrient cycle. Public health is impacted by environmental biotic variables. Due to the shared environment between humans and animals, diseases can spread from one to the other. Zoonosis is the name for a disease or infection that is naturally transmitted from animals and can have negative health effects. Zoonosis is spread through the air, contaminated food, close contact with diseased animals, and vector bites. Animals and people have developed a tight affinity.

Infectionsusing pathogens are most likely to affect humans. A study reveals that 61% of 1,415 known pathogenic organisms for humans are transmitted by humananimal contact. Crossspecies transmission occurs as a result of agricultural operations, domestication of livestock, encroachment on wild areas, deforestation, and humananimal conflicts that bring animals and humans closer together. Emerging infectious diseases brought on by zoonosis include SARS Severe Acute Respiratory Syndrome), pandemic influenza H1N1, and the Ebola virus. Numerous environmental factors, such as climate change, ozone depletion, ecosystem change, biodiversity loss, urbanisation, inadequate sanitation facilities, changes in the hydrological system, and the availability of fresh water, influence the spread of infectious diseases.

Research demonstrates that variables like precipitation, humidity, temperature, and air flow are determinants of virus infection and transmission. While studies have shown that 70% to 90% of diseases are caused by a variety of environmental variables, chronic disease may be caused by both genetic and environmental causes in order to improve present controls and manage spontaneous epidemics, it is crucial to determine how long viruses may survive outside of their host.[1-11].

II.SARS CORONA VIRUS

According to SARS-CoV, the coronavirus-related respiratory illness known as Sever Acute Respiratory Syndrome is caused by one of the 36 coronaviruses of the family Coronavirdae of the order Nidovirales.The isolation of SARSCoV from palm civets and horseshoe bats has been revealed in a scientific study, demonstrating that SARSCoV is a zoonotic virus. According to a study, spring is a better time than fall and winter for SARS to spread Low humidity, high barometric pressure, and significant daily temperature changes are all aspects of the weather that help prevent

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illness. Members of the Coronavirdae are known to cause respiratory or intestinal illness in humans and other animals (Yuan et al., 2006).

At room temperature, the SARS virus can remain contagious in human serum for up to four days. The viral infectivity on materials that are frequently used in daily life remained for 60 hours after exposure, started to decline a day later, and was reported to retain infectivity in dried form even after 6 days. HCoV-229E, a previously known human coronavirus, is less stable than SARS-CoV. Both 4 and 25 degrees Celsius were found to be suitable for the virus to survive in this water, but the infectivity was lower at 25 than at 4, demonstrating that temperature has a major impact on virus infectivity. The ideal temperature for SARS is 16°C to 28°C. SARS-CoV is easily inactivated thermally and chemically, with thermal inactivation of SARS-CoV at 56° and 60° being very efficient. Aersolization of such an infected virus would increase the infection rate. Ambient temperature has an impact on a virus's pathogenicity, virulence, ability to replicate, and infectivity.

Studies show that around 56 oC, a virus loses its ability to spread after 15 minutes.The human coronavirus 229E and TGEF both had better survival rates at low RH than at high RH, according to a study. Small air droplets between 5 and 20 micrometres in diameter can evaporate quickly, and if they contain a virus, they will either suspend in the air or stick to nearby surfaces (B. Wang et al., 2005). With high humidity > 40% and enormous droplets > 50 m, the evaporation rate slows and the droplets fall to the ground, but in dry air, they remain suspended in the air and are dangerous if a virus is present (B. Wang et al., 2005). The coronavirus that causes SARS is susceptible to UV radiation; after 30 minutes of exposure at 1,62,000 WS/cm2, the virus' infectivity was very low, and after 60 minutes, it was undetectable. Many studies link SARS-CoV to meteorological conditions and air pollution. The chance of getting SARS can be reduced by taking preventative measures like washing your hands and wearing a mask, however the literature that is now available does not yet show a connection between environmental factors like pH, salinity, osmotic pressure, and atmospheric pressure and SARSCoV. Future research should take these aspects into account. [13-16]

Virus that causes the flu

The influenza virus family is known as Orthomyxoviridae. Included in this virus family are viruses that have a segmented negative-sense single strand RNA genome. There are four major types of influenza viruses: influenza types A and B infect people each year during the epidemic season. The many subtypes of influenza A are created by the interaction of the proteins hemagglutinin (H) and neuraminidase (N), which are formed on the surface of the viruses.Hemagglutinin type 1 and neuraminidase type 1 are the two main surface antigens of the 2009 swine flu, which originated in Mexico. There are 11 distinct neuraminidase subtypes and 18 distinct hemagglutinin subtypes. The H and N kinds of influenza A viruses, such as H1N1 and H3N2, can be used to classify them. Viruses that cause influenza A, B, and C can infect humans. H5N1, H5N6, H6N1, H7N2, H7N3, H7N4, H7N7, H7N9, H9N2, H10N7, and H10N8 are influenza virus subtypes that can occasionally cross the species barrier from birds to mammals and cause sporadic illnesses or fatalities.

The swine influenza virus H1N1 has 8 strands of RNA made up of a combination of three different strains: 1 strand from human fluThe most common ways that the influenza virus spreads through the air are coughing, sneezing, talking, exhaling breath, showering, tap water use, sewage aerosolization, wetcleaning of indoor surfaces, and agricultural spraying. The H1N1 strain of influenza type A virus was the cause of the human pandemic of swine influenza virus infection. Human-to-person airborne contact and human contact with things containing the virus are the two main ways that swine flu spreads.Fever, a sore throat, a cough, chills, weakness, and body aches are all signs of the swine flu.The infectious phase of H1N1 lasts for roughly 5 to 7 days after the onset of symptoms, according to Kothalawala et al. (2006) and Pawaiya et al. (2009). Due to the swine flu virus's rapid rate of mutation, propensity for gene segments to reassert themselves, and abundance of influenza viruses in both birds and mammals, it is difficult to develop an efficient, long-lasting vaccine. According to a study on the phytochemical examination of water used as a habitat for ducks, the influenza virus persisted longer at temperatures below 17°C, at lower salinities, and at higher dissolved oxygen levels (Keeler et al., 2014; Sooryanarain&Elankumaran, 2015). [17-18]

The majority of influenza A viruses, including those that cause human, swine, and avian infections, can survive at neutral pH levels. However, at pH 7.4, even a small change in pH can significantly affect a virus' ability to survive in its environment.

The H5N1 virus showed a 45-day reduction in environmental stability. High ambient humidity levels are thought to surface-inactivate lipid-containing viruses like influenza. The infectivity of viruses increases between 7% and 23% of relative humidity, while it starts to drop at 43%.Throughout the winter, it is seen that absolute humidity increases indoors and outdoors, which enhances influenza viral survival and virus transmission. The upper respiratory tract contracts in cold air, reducing the respiratory system's natural defences and fostering the optimum environment for respiratory viruses to propagate sickness (Lowen et al., 2007). Influenza viruses are more stable at 5°C than they are at 30°C.At these temperatures, virus stability is increased because virus half-life increases at lower temperatures (Lowen& Steel, 2014). High temperatures have an impact on the human influenza virus, claims research. Proteases are less active and the viral envelope goes through additional physical changes that support viral stability at lower temperatures. Heat-induced suppression of viral RNA synthesis Even if it is very possible that this virus may cause a viral illness, we can avoid it if we take the proper precautions and stay away from infected areas.

Virus Ebola

The Ebola virus is what causes the disease (EVD). The Ebolavirus is a member of the family Filoviridae, along with the Cuevavirus, Marburgvirus, and Marburgvirus genera. There are now six known species of the Ebolavirus genus, including ones from Zaire, Bundibugyo, Sudan, Ta Forest, Reston, and Bombali (Piercy et al., 2010). Viral filaments can extend up to 14,000 nm in length and are enveloped in lipid membranes. They are uniformly 80 nm wide as well. Seroprevalence studies in bats suggest that adults and pregnant females have high rates of seropositivity, which leads to the notion that fighting and mating among bats causes transmission of the virus. Each virus consists of a single single-stranded, negative-sense RNA molecule. Fruit bats from the Pteropodidae family are EBOV's natural hosts. The incubation period of the virus is typically between 4 and 10 days, however it has occasionally been seen to be as short as 2 days and as long as 21 days. Fruit bats that have eaten fruit that has been partially chewed by a non-human primate may become infected with EBOV and then infect people. Furthermore, the Ebola virus can spread from an infected person's blood and bodily fluids to an infected object.

It is unclear how the Ebola virus behaves in contexts other than its host. Nikiforuk et al. (2017) and Pinzon et al. (2004) both claim that the conclusion of the rainy season in December and January coincides with the emergence of EVD. Human and nonhuman monkey blood that has been dried up can contain the Ebola virus for five days. Whole blood and plasma contain the virus for more than 120 hours (Palyi et al., 2018). The ebola virus Ebola virus Makona variety has been reported to persist on stainless steel and plastic covered surfaces for 192 hours, hence the dead corpses of ebola virus victims should be handled cautiously because the infection can survive in dead persons for more than seven days (Cook et al., 2015).

There is a link between the Ebola virus sickness and high absolute humidity and low temperatures. In a study, it was found that the Ebola virus Zaire can survive on glass for more than 10% of the time and plastic for more than 3% of the time at 4 oCEbola virus is still viable for 50 days at 50 degrees Celsius (0.1 to 1At 27 oC, a virus can survive in wafers for up to 3% of the time. The aresol stability of EBOV Mayinga 1976 and EBOV Makona 2014 can be compared, with the latter being less stable. The aresol phase of EBOV can last for three hours at 22 °C and 80% relative humidity. ZEBOV and REBOV both degrade in minuscule aerosol particles at rates of 4.29% min-1 and 2.72% min-1, respectively (The stability of the Ebola virus outside of the host has to be better understood). [18-19]

III. CONCLUSION

The analysis above suggests that environmental conditions have an effect on the rates of virus survival and infection. Both biotic and abiotic factors affect how the virus is spread, infected, and transmitted. The surfaces they live on and different types of fluids (blood, serum, faeces, and water droplets) have an impact on the three viruses discussed in this review—the coronavirus, the influenza virus, and the ebola virus. We should take simple preventive measures to safeguard ourselves from getting sick.By taking the correct precautions, we may establish a barrier between ourselves and a dangerous environment. Everyone should start by maintaining good personal cleanliness.Cleaning up after using the restroom, taking regular showers, and washing your hands before eating are all healthy behaviours that will protect us from infectious agents. Since infectious organisms can survive in bodily fluids like sweat and blood, sharing clothing, razors, and other personal things should be avoided. The majority of infectious agents enter the body through the mouth and nose.

One should regularly wash their hands or use hand sanitizers when working in a hazardous location. Also necessary are gloves and a face mask. Don't touch your mouth, nose, eyes, or other facial features. Avoid being in close proximity to other people and crowded situations.

At the home and at work, surfaces should be regularly cleaned with surface disinfectants. As zoonosis is one of the primary ways that infectious diseases spread, it is crucial to thoroughly boil meat and animal products before consuming them. One of the key responsibilities of the government is to ensure the health and safety of the populace. If disease epidemics are present, the government has the power to remove residents from a small region. Boiling water before drinking is advised because it kills many bacteria and viruses. Yet, lockdowns and quarantines can be helpful safety precautions in the event of an epidemic or pandemic when there is no way to flee.

Understanding the path of transmission and environmental stability of infectious agents allows the government to formulate the proper legislation. These recommendations will allow people to work in dangerous environments without getting sick.Research on ambient pH is well known for influenza viruses, but we were unable to find any literature that could show a direct link between SARS-CoV survival and environmental pH.More research is needed to better understand the ebola virus' environmental stability outside of the host.

We can help prevent viral sickness by comprehending and being adequately informed about our environment, particularly its viral stability.

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