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Solar ultraviolet radiation sensitivity of SARS-CoV-2

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), can be life-threatening; the outbreak of this disease was characterised as a pandemic by WHO on March 11, 2020.[1] COVID-19 is currently a global health issue and governments are taking a series of measures to reduce the spread of the virus among communities. Factors affecting the survival of SARS-CoV-2 need to be clarified and the effect of solar ultraviolet radiation is one subject under discussion.[2]

The output of both the popular and scientific press have included hopeful speeches by politicians or scientists suggesting that the transmission of SARS-CoV-2 will be contained within the coming months because of increasing temperatures and solar ultraviolet radiation during the summer season in countries in the northern hemisphere. However, solar ultraviolet radiation and ultraviolet germicidal irradiation (UVGI) are not the same. To evaluate effectiveness of ultraviolet radiation, we need to consider the virology of SARS-CoV-2, an enveloped, single stranded RNA virus. SARS-CoV-2 is a novel betacoronavirus and showed 88% genome similarity with two SARS-like coronaviruses (SL-CoV) found in bats: SL-CoV-ZC45 and SL-CoVZXC21.[3] Human-to-human transmission occurs via droplets (by direct or indirect contact)[4] and viral droplets can survive on various surfaces for several hours, despite reductions in the viral load.[2] This information shows that, despite their enveloped structure, SARS-CoV-2 is quite resistant to environmental conditions.

During epidemics and pandemics, disinfection of environments is crucial, particularly for airborne diseases.[5] The advantages offered by ultraviolet radiation make UVGI (ultraviolet disinfection) a very effective disinfection tool.[6] Ultraviolet light can be classified into three subtypes by radiation wavelengths: ultraviolet A (320-400 nm), ultraviolet B (280–320 nm) and ultraviolet C (200–280 nm).[7] The commonly used wavelength for UVGI is ultraviolet C because its germicidal effectiveness peak wavelength is 260–265 nm, which is equivalent to the peak of ultraviolet radiation absorption of nucleic acids.[7] It is known that as the ultraviolet wavelength decreases, the germicidal effect of ultraviolet radiation increases.[8] Therefore, ultraviolet wavelengths below 320 nm are classed as actinic—ie, causing photochemical reactions. Since ultraviolet A radiation is insufficiently absorbed by viral nucleic acid, ultraviolet A radiation is not considered germicidal.[7]

Unfortunately, ultraviolet A is the major ultraviolet component of sunlight reaching the ground.[8] Ultraviolet B radiation can also have a small germicidal effect,[7] but only a small portion of it reaches the Earth's surface as most is absorbed by the atmosphere.[8] Ultraviolet radiation that is totally absorbed by the ozone layer is accepted as having the optimum germicidal wavelength—ie, ultraviolet C radiation.[8] Unifying all these principles, it is clear that sunlight reaching the ground lacks germicidal ultraviolet C radiation.[7,8] Studies show that UVGI methods can be used effectively to eliminate viruses—eg, in health-care facilities, schools, indoors, etc—by using special ultraviolet radiation systems (ultraviolet C lamps, chambers). Also, it is known that the ultraviolet absorption peak of RNA viruses is around 250 nm wavelength.[7] Therefore, the germicidal effectiveness of ultraviolet C radiation is limited to such applications and sunlight is not an alternative. However, some studies based on SARS-CoV, have shown that at least 60°C (which the earth does not reach to this temperature) and a minimum of 90 min are required to inactivate SARS-CoV-2.[9]

In the absence of scientific evidence showing ultraviolet B radiation's germicidal effectiveness on SARS-CoV-2, both politicians and scientists should avoid voicing assumptions on the effect of sunlight on viral transmission. Such uninformed statements can promoted misunderstanding and offer unrealistic hope to communities. This misunderstanding can also cause lethargy with regard to the government measurements in place in the community. Further studies should be done by simulating complex environmental conditions, in which a number of variables will test the effectiveness of ultraviolet B radiation against environmental SARS-CoV-2.

We declare no competing interests.

*Ayse Seyer, Tamer Sanlidag
aseyer@ciu.edu.tr

Department of Medical and Clinical Microbiology, Cyprus International University, Nicosia, 99258, Cyprus (AS); Department of Medical Microbiology, Celal Bayar University, Manisa, Turkey (TS); and Experimental Health Sciences Research Institute, Near East University, Nicosia, Cyprus (TS)

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