Letter to Editor

Covid-19 pandemic and weather conditions: Can temperature curb the spread?

Nuray Colapkulu¹, Feride İrem Simsek², İhsan Metin Leblebici^{1,3}, Orhan Alimoglu^{1,3}

Abstract

The coronavirus disease 2019 (Covid-19) pandemic began in December with the first case detected in Wuhan, China. As Covid-19 rapidly spread through human-to-human contact, it was declared a pandemic. How severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) acts in different weather conditions, whether it shows seasonal changes, and if these two factors affect the course of the pandemic are among the frequently asked questions. It is known that many virus pandemics are affected by seasonal conditions and often occur in winter when immunity is weakened. Studies reporting that the spread of Covid-19 will decelerate in summer are in the majority. The results of studies in which multiple countries have been evaluated, in particular, are that the increased temperature and humidity will reduce the spread of the virus. Studies have also claimed that Covid-19 is not affected by weather conditions. There is yet no definite evidence in how the seasonal change will be manifested in SARS-CoV-2. Measures for protection from the infection are essential to control the pandemic.

Key words: Covid-19; pandemics; seasons; weather conditions.

International Journal of Human and Health Sciences Vol. 05 No. 02 April'21 Page : 264-266

DOI: <http://dx.doi.org/10.31344/ijhhs.v5i2.273>

Behaviors of respiratory viruses is affected by various factors, such as seasonal changes like temperature, humidity, sunlight, as well as behaviors and vitamin values of the hosts. Influenza virus, human coronavirus and respiratory syncytial virus have a peak incidence in winter, whereas non-rhinovirus enteroviruses have its peak incidence in summer. The severe acute respiratory syndrome coronavirus epidemic and the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic also appeared in the winter. Low temperature and humidity reduce mucociliary clearance, increase the secretion of mucus in the respiratory tract, disrupt the integrity of the epithelial tissue of the respiratory tract, and result in loss of the cilia in epithelial cells. High temperatures have the potential to weaken the defenses against the virus by disrupting virus-specific adaptive immunity. Due to the short days of winter, the lack of sunlight reduces vitamin D, which also might contribute to nonspecific

immune response.¹

In a study where the relation between Covid-19 mortality and the parameters of temperature, humidity and diurnal temperature range parameters were evaluated, a negative correlation between relative humidity and mortality ($r = -0.32$) and a positive correlation with the diurnal temperature range ($r = 0.44$) was obtained.² Increased diurnal temperature range and decreased humidity and air temperature in winter are associated with increasing mortality in diseases of the respiratory system, leading to bronchial constriction in the lungs, a decrease in the functions of the alveolar macrophages, and a decrease in immune functions.³

A study with air temperature data from 122 cities in China found no evidence that the spread of the Covid-19 infection was affected by ambient temperature.⁴ Another study conducted in China reported that there was no correlation between ultraviolet light, temperature, and the average

1. Department of General Surgery, Istanbul Medeniyet University, Medical Faculty, Istanbul, Turkey.
2. 3rd year Medical Student, Faculty of Medicine, Istanbul Medeniyet University, Istanbul, Turkey.
3. Istanbul Medeniyet University Africa Health Training and Research Center (MASAM), Istanbul, Turkey.

Correspondence to: Prof. Dr. Orhan Alimoglu, Department of General Surgery, Faculty of Medicine, Istanbul Medeniyet University, Goztepe Training & Research Hospital, 34722, Kadikoy, Istanbul, Turkey. E-mail: orhan.alimoglu@medeniyet.edu.tr

number of people infected secondarily by the SARS-CoV-2-infected proband.⁵ These results are believed to have been affected by the fact that the study was conducted during the winter months.

In Indonesia, one of the countries where the virus spread rapidly, the relation between temperature humidity, rain and the daily Covid-19 cases was evaluated and there was only negative correlation between the number of cases and the average temperature ($r = 0.392$; $p < .01$).⁶ The evaluation of the average temperatures, humidity, and wind speed of the 10 provinces in Turkey with the highest number of cases found that there was a negative correlation between the air temperature and the increase in the number of cases ($r_s = -0.483$). This means the increase in temperature reduces the increase in the number of cases. The average wind speed and the number of cases 14 days before were found to be positively correlated ($r_s = 0.550$), suggesting that the average increase in wind speed increases the number of cases. Although the study did not yield precise result because of reasons such as the limited number of cities where the study was conducted, quarantining of citizens from abroad only in certain provinces and pandemic measures, it could suggest that weather condition affects the spread of the Covid-19 pandemic.⁷

According to a study, global data set an R value that gives the effective rate at which Covid-19 spreads to calculate the risks to countries in March and July based on the change in the R value in these months using the 2019 global weather data. The factors of R value, temperature, relative humidity, income status, population density, number of hospital beds, and population ratio of those aged over 65 yielded this result. The effect of temperature and relative humidity on R value was approximately 20%.⁸

Based on the temperature data of March 2020 and the number of reported Covid-19 cases in 88 countries, the growth rate of the Covid-19 pandemic was decreased with increasing

temperature (p-value 0.0034). According to the data, the maximum spread rate (7.7 ± 3.6) peaked at approximately $7.7^\circ\text{C} \pm 3.6^\circ\text{C}$. When low income countries, where temperature is high in March and which are believed to be unable to fully reflect the actual size of the pandemic caused by limited testing capacity, were excluded from the assessment to prevent biased results, no big difference was observed in the results either. Given the results, the intensity of the pandemic is expected to reduce in the Northern hemisphere in the coming months, whereas the opposite is expected for the Southern hemisphere.⁹

Researchers have argued that as the society has not yet become immune to the SARS-CoV-2 virus, it will be the main determinant of the spread of the virus during the summer when temperature is high, just as it has been since the onset of the pandemic. As people gain immunity, Covid-19 could be encountered less frequently in the summer, like other coronaviruses. Although the increase in temperature cannot directly reduce the rate of spread of the virus, it can help control the pandemic together with measures such as physical distancing and wearing masks.¹⁰⁻¹³

Since the effect of seasonal changes on the spread of SARS-CoV-2 is not clearly known, physical distancing is one of the most valuable measures to be taken until an effective treatment or vaccine for Covid-19 is found. Even if Covid-19 is affected by seasons, there is no guarantee yet of it not leading to a new pandemic in autumn along with other viruses such as influenza after the pandemic has lost its effect in the summer season and not putting a burden on the healthcare system.

Conflict of interest: Authors declare no conflict of interest.

Funding: None received.

Authors's contribution: Data gathering and idea owner of this study: NC, FIS, OA. Study design: NC, FIS. Writing and submitting manuscript: NC, FIS, IML, OA. Editing and approval of final draft: IML, OA.

References:

1. Moriyama M, Hugentobler WJ, Iwasaki A. Seasonality of respiratory viral infections. *Annu Rev Virol* 2020;7:2.1-2.19.
2. Ma Y, Zhao Y, Liu J, He X, Wang B, Fu S, et al. Effects of temperature variation and humidity on the death of COVID-19 in Wuhan, China. *Sci Total Environ* 2020;724:138226.
3. Martens WJ. Climate change, thermal stress and mortality changes. *Soc Sci Med* 1998;46(3):331-44.
4. Xie J, Zhu Y. Association between ambient temperature and COVID-19 infection in 122 cities from China. *Sci Total Environ* 2020;724:138201.
5. Yao Y, Pan J, Liu Z., Meng X, Wang W, Kan H, Wang W, Kan H, et al. No Association of COVID-19 transmission with temperature or UV radiation in Chinese cities. *Eur Respir J* 2020;55(5):2000517.
6. Tosepu R, Gunawan, J, Effendy DS, Lestari H, Ahmad LAI, Lestari H, Bahar H, et al. Correlation between weather and Covid-19 pandemic in Jakarta, Indonesia. *Sci Total Environ* 2020;725:138436.
7. Sahin M. Impact of weather on COVID-19 pandemic in Turkey. *Sci Total Environ* 2020;728:138810.
8. Wang J, Tang K, Feng K, Lin X, Welfeng L, Chen K, et al. High Temperature and High Humidity Reduce the Transmission of COVID-19. 2020 arXiv:2003.05003.
9. Notari A. Temperature dependence of COVID-19 transmission. 2020 arXiv: 2003.12417.
10. Haque M. Combating COVID-19: A Coordinated Efforts of Healthcare Providers and Policy Makers with Global Participation Are Needed to Achieve the Desired Goals. *Bangladesh Journal of Medical Science* 2020;19:1-5.
11. Ashiq K, Ashiq S, Bajwa MA, Tanveer S, Qayyum M. Knowledge, attitude and practices among the inhabitants of Lahore, Pakistan towards the COVID-19 pandemic: an immediate online based cross-sectional survey while people are under the lockdown. *Bangladesh Journal of Medical Science* 2020;19:69-76.
12. Alimoglu O, Kilic F, Erol CI, Eren T. What the COVID-19 pandemic means for sub-Saharan African countries? *International Journal of Human and Health Sciences* 2021;5(1):127-28.
13. Mojumder, Paul S, Banik R, Ferdushi HM. COVID-19 detection by salivary analysis: Easy and reliable approach in massive outbreak. *International Journal of Human and Health Sciences* 2021;5(1):7-11.