



Can sunlight affect COVID-19 outcomes? What is the available evidence?

Mohammad Reza Khazdair¹, Andy Goren²

¹Cardiovascular Diseases Research Center, Birjand University of Medical Sciences, Birjand, Iran

²Applied Biology Inc., Irvine, CA, USA

Dear Editor,

Coronavirus disease 2019 (COVID-19) has rapidly spread into a global pandemic that challenges the economic, medical, and public health stability of nations worldwide.¹ Severe acute respiratory syndrome coronavirus (SARS-CoV)-2, first identified in China in December 2019 as the "novel coronavirus," causes COVID-19 by utilizing angiotensin-converting enzyme 2 receptors and transmembrane protease, serine 2 (TMPRSS2, located on host cell surfaces) for entry and infection. Thus, TMPRSS2 is required for SARS-CoV-2 infectivity.¹

Interestingly, total prostate-specific antigen levels vary by season. The prolonged daylight hours of spring and summer are associated with reduced androgen sensitivity, which lowers TMPRSS2 expression and subsequently reduces SARS-CoV-2 infectivity. Conversely, the shortened daylight hours of autumn and winter are associated with increased SARS-CoV-2 infectivity.²

Dopico et al.³ demonstrated that the cellular composition of blood also varies by season: soluble interleukin (IL)-6 receptor and C-reactive protein concentrations increase during winter and estradiol receptor gene expression increases during summer. This is pertinent because SARS-CoV-2 infections cause cytokine storms and systemic inflammatory responses that are mediated by the release of large amounts of pro-inflammatory cytokines and chemokines (e.g., IL-1b, IL-6, and interferon- α) from immune effector cells.¹

Sunlight exposure mediates the conversion of previtamin D3 (precholecalciferol) into vitamin D3 (cholecalciferol) by liver enzymes. Vitamin D receptors are highly expressed by monocytes and by B and T lymphocytes, which modulate immune cell function. Thus, vitamin D deficiency is primarily associated with increased susceptibility to, and severity of, many infectious diseases. More specifically, it is associated with low concentrations of the pro-inflammatory cytokine IL-6, which plays a significant role in COVID-19-induced acute respiratory distress syndrome. In addition, low 25-hydroxyvitamin D concentrations may increase COVID-19 mortality.⁴ Taken together, studies indicate that sunlight improves immunity by increasing vitamin D production and thus may be useful for the treatment of COVID-19.

The environmental survival of viruses such as SARS-CoV-1 depends on factors, including sunlight, humidity, and temperature. On the other hand, 90% of SARS-CoV-2 is inactivated every 6.8 minutes in simulated saliva and every 14.3 minutes in culture media exposed to simulated sunlight (representative of summer at 40°N latitude). Indeed, during summer, 11 to 34 minutes of midday sunlight can inactivate $\geq 90\%$ of SARS-CoV 2 viruses in most locations.⁵

In conclusion, sunlight modulates immune system function by inducing vitamin D production.

eISSN: 2383-4625

Received: 15 March 2021

Revised: 13 April 2021

Accepted: 20 April 2021

Correspondence to:

Mohammad Reza Khazdair
Cardiovascular Diseases Research
Center, Birjand University of Medical
Sciences, Ghafari Street, Birjand, South
Khorasan 9717853111, Iran
E-mail: khazdairMR@Bums.ac.ir
ORCID
<https://orcid.org/0000-0001-9854-6121>



How to cite this article:

Khazdair MR, Goren A. Can sunlight affect COVID-19 outcomes? What is the available evidence?. Clin Exp Emerg Med 2021;8(3):249-250. <https://doi.org/10.15441/ceem.21.045>

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>).

It also reduces androgen sensitivity and lowers TMPRSS2 expression. Considering that SARS-CoV-2 are dependent on TMPRSS2 for infectivity, sunlight may be useful in the fight against SARS-CoV-2.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382:1708-20.
2. Salama G, Noirod O, Bataille V, et al. Seasonality of serum prostate-specific antigen levels: a population-based study. *Eur Urol* 2007;52:708-14.
3. Dopico XC, Evangelou M, Ferreira RC, et al. Widespread seasonal gene expression reveals annual differences in human immunity and physiology. *Nat Commun* 2015;6:7000.
4. Laird E, Rhodes J, Kenny RA. Vitamin D and inflammation: potential implications for severity of Covid-19. *Ir Med J* 2020; 113:81.
5. Sagripanti JL, Lytle CD. Estimated inactivation of coronaviruses by solar radiation with special reference to COVID-19. *Photochem Photobiol* 2020;96:731-7.