

How Sun Exposure Improves Your Immune Function

Analysis by [Dr. Joseph Mercola](#)

January 26, 2024

STORY AT-A-GLANCE

- › Sensible sun exposure has many health benefits. Many are the result of vitamin D production, which occurs when your skin is exposed to UV light, but many others are unrelated to vitamin D
- › Research shows both blue light and UVA light boosts the activity of T lymphocytes. As little as five to 10 minutes of sun exposure was needed to boost immune cell activity
- › The healthiest blue light is from the sun, as it is balanced by near-infrared radiation, which activates cytochrome C oxidase in your mitochondria and helps optimize ATP production

Editor's Note: This article is a reprint. It was originally published January 23, 2017.

Mounting research confirms that sun avoidance may be at the heart of a large number of health problems. Not only does your body produce vitamin D in response to sun exposure on bare skin, but sunlight also produces a number of other health benefits that are unrelated to vitamin D production.

In fact, humans appear to have a lot in common with plants in this regard – we both need direct sun exposure in order to optimally thrive, and while artificial lighting sources offering specific light spectrums may be helpful for various problems, ideally we need the full spectrum of light that natural sunlight offers.

More recently, researchers at Georgetown University Medical Center (GUMC) published a laboratory study using cells in petri dishes, showing that exposure to blue and

ultraviolet (UV) light increases T cell activity – white blood cells involved in immune function and fighting infections.^{1,2,3}

Sunlight Is a Natural Immune Booster

This is thought to be the first study showing an impact of light on this particular type of immune cell, so more research is needed to verify the results. However, there's plenty of evidence in the medical literature confirming that sunlight has immune-boosting properties.

In this study,⁴ light was found to stimulate the production of hydrogen peroxide, which boosted the activity of T lymphocytes. As little as five to 10 minutes of sun exposure were needed to boost immune cell activity. As noted in one news report:⁵

"Given the large surface area of human skin, all of the T cells present in skin could potentially benefit from this phenomenon through exposure to blue light, the researchers suggest.

Note that vitamin D is only produced in the body via exposure to UVB rays, which can be harmful in cases of prolonged sun exposure.

If blue light from the sun's rays is capable of energizing infection-fighting T cells, it could be a potential means of treatment for boosting immunity in many patients, the researchers conclude."

While the researchers appear hopeful that blue light alone might be a valuable immune-boosting treatment, it's important to realize that the biological effects of light can be very complex, and it's important to get it right.

As explained by Dr. Alexander Wunsch, a world class expert on photobiology, excessive exposure to blue light – such as that from LED lighting, which is primarily blue and devoid of near-infrared found in sunlight and incandescent lighting – can be quite harmful, and may be a significant risk factor for age-related macular degeneration (AMD).

The healthiest blue light is from the sun, as it is balanced by near-infrared radiation, which has many important biological functions. Importantly, near-infrared radiation will activate cytochrome C oxidase in your mitochondria and help to optimize ATP production.

T Cells Are Intrinsically Photosensitive

For a long time, it was believed mammals only had photosensitive cells in the eye. We're now finding photosensitive cells in many other areas of the human body.

As noted by the authors, this study demonstrates that "T lymphocytes possess intrinsic photosensitivity and this property may enhance their motility on skin." In other words, T cells sense and respond to light.

Blue light specifically triggers the production of hydrogen peroxide (H₂O₂) in T cells, which triggers a chemical cascade that results in increased T cell motility. The increased motility or activity, in turn, allows the immune cells to function better.

Interestingly, once the T cells are activated they also alter their antioxidant capacity – an effect that appears to allow for greater H₂O₂ production in response to light.

The spectral sensitivity of T cells peaked at both ~350 nanometers (nm), which is in the ultraviolet A (UVA) range, and ~470 nm, which is in the blue spectrum. The latter (470 nm light) has previously been shown to kill methicillin-resistant *Staphylococcus aureus* (MRSA) *in vitro*.⁶

According to lead author Gerard Ahern, Ph.D., an associate professor at the Department of Pharmacology and Physiology in Georgetown, some of the immunity benefits typically attributed to vitamin D may actually be due to this newfound mechanism.

While there may be some truth to that, previous research has teased out a number of different mechanisms for vitamin D's activity, including its bactericidal and immune-boosting effects.

For example, researchers have found vitamin D acts directly on the beta defensin 2 gene (which encodes an antimicrobial peptide) and the NOD2 gene (which alerts cells to the presence of invading microbes).⁷ Vitamin D is also involved in the production of over 200 antimicrobial peptides that help fight all sorts of infections.

Other Health Benefits of Sunlight Unrelated to Vitamin D

This certainly isn't the first time sunlight has been shown to produce biological effects that are important for good health. Other health benefits of sun exposure include the following. To learn more, I recommend reading through "Sunlight: For Better or For Worse? A Review of Positive and Negative Effects of Sun Exposure," published in the journal *Cancer Research Frontiers*.⁸

Raising your vitamin D level – This is probably the most well-known benefit of sun exposure, and there's a robust body of scientific research confirming the many benefits of optimal vitamin D levels.

Importantly, the evidence now clearly shows that once you reach a serum vitamin D level of 40 ng/ml, your risk for cancer plunges by 67%, compared to having a level of 20 ng/ml or less.^{9,10,11,12,13,14}

Even the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine (formerly Institute of Medicine, IOM) has reported an association between vitamin D and overall mortality risk from all causes, including cancer.^{15,16}

Vitamin D also increases your chances of surviving cancer if you do get it,^{17,18} and this includes melanoma patients.^{19,20} Vitamin D is also important for your bone health, cognitive function, immune function and healthy pregnancy and infant development.²¹

The overall health benefits of vitamin D are so significant, a Swedish research team warned that "avoidance of sun exposure is a risk factor for death of a similar magnitude as smoking."^{22,23}

Anchoring your circadian rhythm — Spending time in bright midday sun helps anchor your circadian rhythm, which is important for optimal sleep. The vitamin D you get from sun exposure can also play a role in your sleep.

Surprising as it sounds, scientists have found vitamin D deficiency raises your risk of obstructive sleep apnea.²⁴ In one study, 98% of patients with sleep apnea had vitamin D deficiency, and the more severe the sleep apnea, the more severe the deficiency.

Lowering high blood pressure and reducing risk for heart disease and cancer —

Research has shown that when sunlight strikes your skin, nitric oxide (NO) is released into your bloodstream.²⁵ NO is a powerful blood pressure lowering compound that helps protect your cardiovascular system, cutting your risk for both heart attacks and stroke.

UVB light lowers blood pressure by dilating blood vessels specifically the capillaries in your skin. This directs about 60% of your blood flow there. This then allows the sun's rays to easily penetrate into your blood.

Sunlight has UV rays known to be germicidal and can help kill infections in your blood. This aspect of sunlight was used to treat tuberculosis in the late 19th and early 20th centuries, even awarding a Nobel prize to Finson in 1903 for this work.

According to one 2013 study,²⁶ for every single skin cancer death, 60 to 100 people die from stroke or heart disease related to hypertension. So your risk of dying from heart disease or stroke is on average 80 times greater than your risk of dying from skin cancer.

While higher vitamin D levels correlate with lower rates of cardiovascular disease, oral vitamin D supplements do not appear to benefit blood pressure, and the fact that supplements do not increase nitric oxide may be the reason for this.

Modulating genetic expression related to your inflammatory response — Sunlight also appears to alter genetic expression. Cambridge University scientists showed that

the expression of 28% of the human genetic make-up varies from season to season.²⁷ Some of those genetic changes affect your inflammatory responses.

During winter months, inflammatory immune-system genes are activated, which helps combat infectious microbes, and during the summer the activity of anti-inflammatory gene activity increases.

In essence, during the summer your body begins to combat the damage incurred by the inflammation produced when your immune system is on red alert. But for that, you need sun exposure.

Preventing infectious diseases – Both UV light itself and the vitamin D produced when your skin is exposed to it have potent antimicrobial effects.

While vitamin D increases production of naturally occurring antimicrobial peptides that destroy the cell walls of viruses and bacteria, UV light also increases blood levels of infection-destroying lymphocytes (white blood cells).

Besides boosting rates of cardiovascular disease, widespread sun avoidance may also be responsible for the reemergence of tuberculosis^{28,29,30} (TB), which now kills about 4,100 people every single day.³¹

In 2014, there were 1.5 million TB-related deaths worldwide, making it the No. 1 infectious disease out there. Compare that to the 55,100 who die from melanoma each year (worldwide).

UV light, especially blue light, also acts as a potent disinfectant of your environment. Research has found UV light can reduce the spread of tuberculosis in hospital wards and waiting rooms by 70%,^{32,33} and helps kill 90% of drug-resistant bacteria in hospital rooms.³⁴

Data suggests UV light at 254 nm can kill drug-resistant strains of *S. aureus* and *E. faecalis* in as little as five seconds.³⁵

Boosting brain serotonin, thereby improving mood and mental health – Sun exposure boosts the feel-good brain chemical serotonin, which is in part why you feel better after spending some time in the sun.

Light therapy has long been the go-to treatment for seasonal affective disorder (SAD), and other research suggests it can be useful in the treatment of major depression as well.³⁶ Schizophrenia has also been linked to maternal lack of sun exposure during pregnancy.³⁷

Importantly, you also have serotonin in your gut, and here, vitamin D has been shown to combat inflammation caused by excessive gut serotonin.

In other words, sunlight and vitamin D both play intricate roles in the gut-brain axis, raising levels in the brain while lowering levels in your gut, thereby improving mood on the one hand, while reducing gut inflammation on the other.

Boosting testosterone and protecting male fertility – Sunlight helps boost men's libido by affecting testosterone. Australian research reveals that men's testosterone levels rise and fall with the seasons, peaking during August, and hitting their lowest levels in March.

Researchers at Johns Hopkins have also linked low vitamin D levels with an increased risk for erectile dysfunction (ED).³⁸

Boosting dopamine, thereby protecting against myopia – Australian researchers have found that kids who spend most of their days indoors have significantly higher rates of high degree myopia (short-sightedness).

As reported by The Daily Mail:³⁹ "The researchers believe that the neurotransmitter dopamine is responsible. It is known to inhibit the excessive eyeball growth that causes myopia. Sunshine causes the retina to release more dopamine."

Protect Your Baby's Health With Breastfeeding and Vitamin D

Vitamin D – which is best obtained from sensible sun exposure – is particularly important during pregnancy and breastfeeding. Not only are pregnant women advised to measure their vitamin D level and make sure it's at least 40 nanograms per milliliter (ng/mL), after birth, the American Academy of Pediatrics (AAP) recommends giving infants a daily dose of 400 international units (IU) of vitamin D for the first two months.

Unfortunately, few parents follow these recommendations, thereby putting their children at risk for vitamin D deficiency and related health problems. Research by the Mayo Clinic highlights this risk, noting that the nutritional benefits of breastfeeding do not include vitamin D – especially if the mother is deficient.^{40,41,42}

In an ideal situation, a woman will have optimized her vitamin D before getting pregnant, making sure to maintain a level of 40 to 60 ng/mL for as long as she's pregnant and breastfeeding, because if the mother is deficient in vitamin D, the child, and her milk, will also be deficient. Alternatively, you can give your baby vitamin D drops.

According to previous research⁴³ by Bruce W. Hollis, Ph.D., and colleagues at the Medical University of South Carolina Pediatrics, mothers who took 6,400 IUs per day of vitamin D could safely supply their breast milk with vitamin D to meet, if not exceed, her own and her nursing infant's vitamin D requirements. This may also be a more convenient if not safer alternative to giving the supplement to your baby directly.

How to Reduce Your Risk of Skin Cancer While Benefiting From Sensible Sun Exposure

An important risk factor for melanoma is overexposure to UV radiation either from direct sunlight or tanning beds/lamps. Frying yourself for several hours on the weekend here and there is not a wise choice. You want to take precautions to avoid sunburn at all cost. If you're going to the beach, bring long-sleeved cover-ups and a wide-brimmed hat, and cover up as soon as your skin starts to turn pink.

Realize that unless you have very dark skin you don't need to spend hours in the sun. For lighter-skinned people, optimizing your vitamin D may require mere minutes in the sun

with minimal clothing. Other health effects associated with sun exposure beyond vitamin D production also appear to be fairly fast-acting.

In the featured study, T cells were activated within five to 10 minutes of light exposure. Granted, the cells were in a petri dish, and further research is needed to see whether T cells in your skin react as quickly to sun exposure.

Overall, the evidence suggests the benefits of sensible sun exposure far outweigh the risks of skin cancer. To further minimize your risks while maximizing benefits of UV exposure, here are a few factors to consider. If you pay close attention to these, you can determine, within reason, safe exposure durations.

- You should know your skin type based on the Fitzpatrick skin type classification system, which has been around for decades. The lighter your skin, the less exposure to UV light is necessary. The downside is that lighter skin is also the most vulnerable to damage from overexposure.
- For very fair skinned individuals and those with photodermatitis, any sun exposure may be unwanted and they should carefully measure vitamin D levels while ensuring they have an adequate intake of vitamin D, vitamin K2, magnesium and calcium.
- For most individuals, safe UV exposure is possible by knowing your skin type and the current strength of the sun's rays. There are several apps and devices to help you optimize the benefits of sun exposure while mitigating the risks. Also be extremely careful if you have not been in the sun for some time. Your first exposures of the year are the most sensitive, so be especially careful to limit your initial time in the sun.

Sources and References

- ¹ [Newsweek January 11, 2017](#)
- ² [Georgetown University Medical Center. December 20, 2016](#)
- ³ [EurekAlert! Vitamin D Supplements Could Fight Crohn's Disease. January 27, 2010](#)
- ⁴ [Scientific Reports December 20, 2016; 6: 39479](#)
- ⁵ [News18 December 22, 2016](#)
- ⁶ [Photomedicine and Laser Surgery 2009 Apr;27\(2\):221-6](#)

- ⁷ Infection Control Today. Sunlight Energizes Infection-Fighting T-Cells. December 20, 2016
- ⁸ Cancer Research Frontiers 2016 May; 2(2): 156-183 (PDF)
- ⁹ PLOS ONE, 2016; 11 (4): e0152441
- ¹⁰ PR Web April 6, 2016
- ¹¹ UC San Diego Health April 6, 2016 (Archived)
- ¹² Science World Report April 13, 2016
- ¹³ Oncology Nurse Advisor April 22, 2016
- ¹⁴ Tech Times April 11, 2016
- ¹⁵ Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium
- ¹⁶ J Clin Endocrinol Metab 2013;98:2160-2167
- ¹⁷ Anticancer Research February 2011: 31(2); 607-611
- ¹⁸ University of California. Higher Levels of Vitamin D Correspond to Lower Cancer Levels. April 7, 2016
- ¹⁹ Cancer Therapy Advisor March 23, 2016
- ²⁰ Medscape. Regular Vitamin D Supplements May Lower Melanoma Risk. January 12, 2023
- ²¹ Obstetric Medicine. Update on Vitamin D: More Than Just a Nutrient. March 2014
- ²² Journal of Internal Medicine March 16, 2016 DOI: 10.1111/joim.12496
- ²³ Refinery 29, March 22, 2016
- ²⁴ Bel Marra Health May 3, 2016
- ²⁵ Medical News Today May 8, 2013
- ²⁶ BBC News May 7, 2013
- ^{27, 39} Daily Mail May 2, 2016
- ²⁸ The Lancet February 19, 2000:355(9204); 618-619
- ²⁹ Acta Med Indones. 2006 Jan-Mar;38(1):3-5
- ³⁰ Econotimes March 23, 2016
- ³¹ Huffington Post March 24, 2016
- ³² Science Daily March 17, 2009
- ³³ Imperial College London March 17, 2009
- ³⁴ Healio Infectious News November 2012
- ³⁵ Ostomy Wound Management 1998 Oct;44(10):50-6
- ³⁶ Journal of Clinical Psychiatry 1991 May;52(5):213-6
- ³⁷ BBC News July 20, 2001 (Archived)
- ³⁸ New Hope Network May 2, 2016 (Archived)
- ⁴⁰ Itech Post January 11, 2017
- ⁴¹ Romper.com January 12, 2017
- ⁴² Fox News January 11, 2017
- ⁴³ American Academy of Pediatrics October 2015