

# Vitamin D for COVID-19, Diabetes and Heart Health

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## STORY AT-A-GLANCE

- › Vitamin D levels affect the severity of COVID-19 infection and maintaining optimal levels may reduce symptoms and related long-term complications
- › Vitamin D modulates innate immunity by maintaining the integrity of physical barriers, helping to keep infectious agents from entering the body
- › Vitamin D also affects adaptive immunity, increasing human cathelicidin LL-37, antimicrobial peptides that have both antiviral and antiparasitic properties
- › Vitamin D levels are inversely associated with cardiovascular disease events
- › Supplementing with vitamin D has also been found to prevent diabetes in people with prediabetes, and its beneficial effects on blood glucose and metabolic health are well known

Evidence continues to pile up on vitamin D's therapeutic potential against COVID-19, as well as its usefulness for chronic conditions like diabetes and heart disease. I published a review on the importance of vitamin D for COVID-19 prevention and treatment in October 2020<sup>1</sup> and was widely vilified as a result.

Now, another review has been published highlighting vitamin D's role in managing COVID-19 infection as well as preventing complications. Not only do vitamin D levels affect the severity of COVID-19 infection, the team wrote in the peer-reviewed journal *Cureus*, but maintaining optimal levels may reduce symptoms and related long-term problems.<sup>2</sup>

# Vitamin D Modulates Your Immune System, Reduces Inflammation

One way vitamin D fights COVID-19 is via immune-modulating properties. It influences innate immunity by maintaining the integrity of physical barriers, helping to keep infectious agents from entering the body.

It also affects adaptive immunity, increasing human cathelicidin LL-37,<sup>3</sup> antimicrobial peptides that have both antiviral and antiparasitic properties, and “act as a primary defense against bacteria and other pathogens in the case of inflammation.”<sup>4</sup> Vitamin D also increases secretion of defensin immune proteins, which have antiviral properties. According to the review:<sup>5</sup>

*“As the virus enters the respiratory system, defensins get attached to the influenza virus and accumulated onto the surface of the virus. This reduces the virulence of the virus. Ultimately leading to the destruction of the outer cell membrane thus reducing the viral load.”*

Meanwhile, vitamin D blocks a pathway leading to increased vascular permeability in inflammatory conditions, helping to relieve related symptoms. It also suppresses proinflammatory cytokines and reduces the cytokine storm that causes symptoms in many inflammatory conditions.<sup>6</sup>

## Vitamin D Cut COVID Rates by 54%

A meta-analysis and trial sequential analysis (TSA), the latter of which weighs errors in order to assess if further studies are needed,<sup>7</sup> found giving vitamin D to people with COVID-19 cut risk of death from SARS-CoV-2 by 51% and reduced risk of admission to the intensive care unit (ICU) by 72%.<sup>8</sup>

COVID-19 patients supplemented with vitamin D not only had lower rates of ICU admission and fewer mortality events, but they also had lower rates of COVID-19 infection, by 54%.<sup>9</sup> Further, the TSA revealed “the protective role of vitamin D and ICU

admission showed that, since the pooling of the studies reached a definite sample size, the positive association is conclusive.”<sup>10</sup>

To put it another way, the results suggest “a definitive association between the protective role of vitamin D and ICU hospitalization.”<sup>11</sup> The team shared why it makes perfect sense that vitamin D fights COVID-19, stating:<sup>12</sup>

*“COVID-19 is characterized by high levels of inflammatory markers, including C-reactive protein (CRP), and increased levels of inflammatory cytokines and chemokines. In this sense, various data have demonstrated the anti-inflammatory, antioxidant, and immunomodulatory properties of vitamin D, in addition to the importance of vitamin D for bone health, as well as its role in extra-skeletal function.”*

Specific examples of how vitamin D may be beneficial in the case of COVID-19 include that it:<sup>13</sup>

Maintains pulmonary barrier function	Determines the production of antimicrobial peptides
Enhances neutrophil activity, which boosts the innate immune response	Shifts that adaptive immune response to a more T helper cell-2 type
Reduces the production of pro-inflammatory cytokines	Increases the anti-inflammatory response

Vitamin D is also protective against acute respiratory distress syndrome (ARDS), a lung condition that’s common in severe COVID-19 cases, which causes low blood oxygen and fluid buildup in the lungs. Along with cytokine release syndrome, ARDS is one of the deadliest complications of COVID-19, and vitamin D inhibits the metabolic pathways that may cause it.<sup>14</sup>

## **Low Vitamin D Increases Infection, Post-COVID Complications**

It's clear that people with higher levels of vitamin D are also less likely to die from COVID-19 – and one study suggested that, theoretically, “a mortality rate close to zero” could be achieved if your vitamin D level reaches 50 ng/ml.<sup>15</sup> I've long recommended a vitamin D level of 40 to 60 ng/ml for optimal health and disease prevention.

However, higher levels of 60 to 80 ng/ml may be even better, while a level upward of 100 ng/mL appears safe and beneficial for certain conditions, **especially cancer**. Another study of 489 patients found those with vitamin D deficiency had a 77% increased risk of COVID-19 infection.<sup>16</sup> When your body is deficient in vitamin D, it leads to a number of deleterious outcomes, including increased:<sup>17</sup>

Risk of lung injury	Susceptibility to infection
Blood pressure	Insulin resistance
Smooth muscle calcification	Risk of cardiovascular disease

Vitamin D deficiency may also result in prolonged intracellular inflammation, which drives mitochondrial dysfunction fueling accelerated aging, DNA damage and early cell death. According to the Cureus review:<sup>18</sup>

*“One of vitamin D's main roles is to control oxidative stress, chronic inflammation, and maintain mitochondrial respiratory processes. Vitamin D has important positive impacts on regulating oxidative stress, inflammation, and energy metabolism through its focused mitochondrial activity and subduing of ROS [reactive oxygen species] through a variety of pathways.*

*Having enough of it considerably reduces the risk of developing illnesses where the pathognomonic feature of the development and progression of illness is an inflammatory process ... The fibrotic and “cytokine storm” effects of infection can be countered by vitamin D3.”*

Further, vitamin D is protective against post-COVID complications that may affect the cardiovascular, gastrointestinal, musculoskeletal, endocrine and neuropsychiatric

systems, along with the kidneys.<sup>19</sup>

## **Vitamin D Linked to Cardiovascular Disease Events, Diabetes**

Low vitamin D levels are associated with an increased risk of heart disease, stroke and all-cause mortality.<sup>20</sup> A study involving 5,684 participants also found that vitamin D levels are inversely associated with cardiovascular disease events.<sup>21</sup>

Further, vitamin D deficiency is linked to vascular dysfunction, arterial stiffness and increased thickness of the heart muscle. Dr. Vijay Natarajan, cardiac surgeon at Bharati Hospital, told Indian Express:<sup>22</sup>

*“Blood pressure regulation is also adversely affected by a deficiency of vitamin D. In people with diabetes, better control of blood sugar levels is facilitated by adequate vitamin D levels. So, one can say that vitamin D deficiency aggravates one or more cardiovascular risk factors ... There have been studies to show a link between vitamin D deficiency and obesity ... Unchecked, these risk factors can increase the risk of heart attack and stroke.”*

It's possible that vitamin D influences heart health by optimizing cholesterol and triglyceride levels as well as via improvements in glucose and insulin levels. One study also found vitamin D deficiency leads to a 50% increase in fatal stroke.<sup>23</sup>

On the other hand, supplementing with vitamin D has also been found to prevent diabetes in people with prediabetes,<sup>24</sup> and its beneficial effects on blood glucose and metabolic health are well known. In a systematic review and meta-analysis, vitamin D supplementation led to a reduction in hemoglobin A1C (HbA1C) in adults with Type 2 diabetes,<sup>25</sup> while other research shows it effectively reduces insulin resistance.<sup>26</sup>

Among people with prediabetes, vitamin D supplementation reduced the risk of developing diabetes by 13%, according to additional research,<sup>27</sup> and it's also possible that vitamin D deficiency is related to the increased risk of cancer often seen in Type 2 diabetes patients. According to research published in the International Journal of Molecular Sciences:<sup>28</sup>

*“Vitamin D, via alleviation of insulin resistance, hyperglycemia, oxidative stress and inflammation, reduces diabetes driven cancer risk factors. Moreover, vitamin D strengthens the DNA repair process, and regulates apoptosis and autophagy of cancer cells as well as signaling pathways involved in tumorigenesis i.e., tumor growth factor  $\beta$  (TGF $\beta$ ), insulin-like growth factor (IGF) and Wnt- $\beta$ -Cathenin.*

*It should also be underlined that many types of cancer cells present alterations in vitamin D metabolism and action as a result of Vitamin D Receptor (VDR) and CYP27B1 expression dysregulation.”*

## **Why It’s Best to Get Your Vitamin D From the Sun**

I strongly recommend getting your vitamin D from proper sun exposure, if possible, as it provides benefits beyond vitamin D optimization. Higher levels of vitamin D may even serve as a marker for healthy sun exposure, which in turn may be responsible for many of the health benefits, like reduced risk of cancer and increased longevity, attributed to vitamin D.

Regular sun exposure, for instance, enhances production of melatonin – a potent anticancer agent.<sup>29</sup> However, if you’re unable to get adequate sun exposure each day, vitamin D supplementation may be necessary. The global prevalence of vitamin D deficiency (defined as a level of less than 20 ng/mL) and insufficiency (defined as a level of 20 to less than 30 ng/mL) is 40% to 100%,<sup>30</sup> so many people are lacking.

Further, 20 ng/mL has repeatedly been shown to be grossly insufficient for good health and disease prevention, which means the true prevalence of people without optimal levels of vitamin D is even greater.

Among older adults in the U.S., vitamin D deficiency may even affect up to 100% of the population,<sup>31</sup> not only because they tend to spend a lot of time indoors but also because they produce less vitamin D in response to sun exposure than a younger person with the same sun exposure.

The only way to determine how much sun exposure is enough and/or how much vitamin D3 you need to take is to measure your vitamin D level, ideally twice a year. When supplementing, also remember vitamins D and K2, calcium and magnesium all work together and must be properly balanced for optimal health.

Once you've confirmed your vitamin D levels via testing, adjust your sun exposure and/or vitamin D3 supplementation accordingly. Then, remember to retest in three to four months to make sure you've reached your target level.

The optimal level for health and disease prevention is between 60 ng/mL and 80 ng/mL (150-200 nmol/L), while the cutoff for sufficiency appears to be around 40 ng/mL. In Europe, the measurements you're looking for are 150 to 200 nmol/L and 100 nmol/L respectively.

## Sources and References

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