

# Selenium Can Help Combat COVID

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## STORY AT-A-GLANCE

- › Selenium is an essential factor and trace element and is a component of more than two dozen proteins. It influences viral pathways, helping to reduce severe symptoms of viral infections such as SARS, coxsackievirus, Ebola and HIV-1
- › Data demonstrate there is a positive relationship between the survival rate for people with active COVID-19 infections and selenium levels
- › Selenium is an important nutrient for heart health and is necessary for fertility. It also may help reduce oxidative damage that may lead to cancer, and may help reduce the potential risk for osteoporosis
- › Overexposure to selenium in the environment or from supplements can increase the risk of all-cause mortality. Food sources include Brazil nuts, pasture-raised organic chicken, turkey, eggs, mushrooms and sunflower seeds

The human body is a complex organism that uses multiple essential vitamins, minerals and elements to maintain optimal health. While all are important, integrating appropriate levels of each creates an environment where the body can best care for itself. Selenium is one of those elements.

Selenium is important to health, including inhibiting RNA virus replication and mutations.<sup>1</sup> Based on the role that selenium plays in RNA virus replication, which can lead to severe tissue damage, the authors of one paper proposed that selenium

deficiency or insufficiency may be an important factor in the development of severe acute respiratory syndrome from a COVID-19 infection.<sup>2</sup>

The mineral was discovered in 1817 by Jöns Jacob Berzelius.<sup>3</sup> In manufacturing, selenium is added to glass, which can add a deep red color or bronze tint. It's also used to pigment paint, plastics and ceramics. Selenium may also be added to photocells, solar cells and photocopiers.

You may be most familiar with its addition to dandruff shampoo as it is toxic to the yeast-like fungus, *malassezia*, that causes dandruff.<sup>4</sup> The amount of selenium found in food sources will depend on the selenium found in the soil. Plants accumulate inorganic selenites and selenates and convert them to organic forms.<sup>5</sup>

Selenium levels can be measured in several ways, including plasma and serum concentrations, urine excretion and analysis of hair and nails. By quantifying proteins that use selenium, such as [glutathione-peroxidase](#) and selenoprotein P, researchers can evaluate the functional measure of the selenium status.

## **Low Selenium May Induce Acute Respiratory Symptoms in COVID**

The fuel you provide your body plays an important role in your health and wellness, including infectious disease progression.<sup>6</sup> Selenium is an essential trace element and a component of more than two dozen proteins that are important to reproduction, antioxidant function and infection.<sup>7</sup>

Most selenium is consumed from food, yet in a natural environment, the trace element is distributed unevenly.<sup>8</sup> A paper published in *Environmental Research* cited a World Health Organization report that found over 40 countries where the soil is deficient in selenium. Some of the lowest levels are found in New Zealand, Slovakia, Finland and sub-Saharan Africa.

Additionally, there is an extended area from Northeastern to South Central China, where it is estimated the daily intake of selenium may be as low as 10 micrograms ( $\mu\text{g}$ ) to 17  $\mu\text{g}$ , which is far below the recommended 55  $\mu\text{g}$  of selenium per day. This is crucial since

selenium plays an important role in antioxidant, anti-inflammatory and immune functions.

One selenoenzyme is glutathione peroxidase, which is an important catalyst in the conversion of glutathione, which in turn reduces damage from reactive oxygen species.<sup>9</sup> When glutathione peroxidase is compromised, the downstream effect is an overproduction of cytokines that can induce a **cytokine storm** as seen in severe COVID-19 infections.

## **Selenium Level Is Associated With Rate of Survival**

Selenium also influences other pathways that affect viral diseases. The Environmental Research authors note that HIV-1 infections are much higher in areas of Africa where the soil is deficient in selenium, and testing has revealed that Ebola infections are closely associated with individuals who are severely deficient in selenium.

Coxsackievirus is another RNA virus reviewed by the authors. Although it typically causes a mild illness, severe infections occur in areas of China where selenium is deficient. A severe illness also causes myocardial injury from Keshan disease.

Further research has shown that a **selenium deficiency** can change the morphology of the epithelial cells lining your respiratory tract, which in turn increases your susceptibility to viral infections.

During the first SARS outbreak in 2003, researchers found selenium deficiency was a significant reason that patients experienced atypical pneumonia. Animal studies also demonstrated that the survival rate was higher when selenium was present.

The authors suggest that each of these pathways influences an individual's reaction to a COVID-19 infection. The oxidative stress triggered by the RNA virus alters the cells' defenses, including glutathione peroxidase. They theorized that supplementation during an active infection may help reduce damage to the **endothelial cells**.

Other studies have demonstrated a positive relationship between the survival rate for people with active COVID-19 infections in China and selenium levels measured in human hair.<sup>10</sup> Similar results<sup>11</sup> were found in patients with COVID-19 in Germany, in which those who survived had higher levels than those who died from the infection.

An exploratory study<sup>12</sup> in India analyzed the blood serum levels of selenium in 60 patients, 30 of whom appeared healthy and 30 had confirmed COVID-19 infections. Those with lower levels of selenium were more likely to be infected.

In another paper,<sup>13</sup> researchers theorized supplementation with sodium selenite may help prevent infection and strengthen the immune system. They also proposed using sodium selenite as an anticoagulant, following research demonstrating “the formation of microclots are a significant cause of death in patients with COVID-19.”<sup>14</sup>

## Nutrients Important to Immune Health

As I discussed with James DiNicolantonio and Siim Land in “[Simple Strategies That Will Improve Your Immunity](#),” your immune system is the first line of defense against infectious diseases. There are four top nutrients important to maintaining the function of your immune system, of which selenium is one.

Vitamin D may be the most important nutrient, however. According to DiNicolantonio, vitamin D activates more than 2,000 genes and helps the body produce powerful antimicrobial and antiviral peptides. To convert vitamin D into an active form your body also requires magnesium. This is also required for immune cell function. DiNicolantonio notes:<sup>15</sup>

*“People who have genetically low magnesium in their natural killer (NK) cells and their CD8 T-killer cells ... their immune system is down. They have chronic activation of Epstein-Barr, which 95% of us are infected with, and they're at a much higher risk of lymphoma.”*

In DiNicolantonio's and Land's book, “[The Immunity Fix: Strengthen Your Immune System, Fight Off Infections, Reverse Chronic Disease and Live a Healthier Life](#),” they

discuss how being deficient in one nutrient can potentially raise the risk for immunodeficiency and why nutrient deficiencies may lead to many of the poor outcomes associated with COVID-19.

The other two important nutrients are **zinc** and selenium. Research has demonstrated that taking zinc at the **onset of cold symptoms** can cut the duration, but as DiNicolantonio points out, it must be taken correctly. He explains:<sup>16</sup>

*“If you're using lozenges, you have to take it every two hours. You got to take it within 24 hours of symptom onset. You have to take about 18 milligrams per dose, and you have to get the total daily dose over 75 milligrams.”*

About selenium, DiNicolantonio says:<sup>17</sup>

*“If you look at other RNA viruses that are nonvirulent, like coxsackievirus, which can cause hand, foot and mouth [disease]. If you're deficient in selenium, that leads to Keshan disease, which is cardiomyopathy. So if you're deficient in selenium, that can take a nonvirulent RNA virus and make it virulent and cause induced cardiomyopathy, and you treat these patients by simply giving them selenium.*

*So I think selenium is a huge player not only from that perspective, but a lot of these studies have shown that most COVID patients are [vitamin] D deficient, selenium deficient, zinc deficient, vitamin C deficient.”*

## **Mitigates Cancer Risk and Essential for Heart Health**

In my interview with Mark Whitacre, he noted the relationship between **exposure to free radical damage** and cancer development. Selenium plays important and interrelated roles at the cellular level in the development of glutathione peroxidase and the protection against reactive oxygen species, both of which help reduce your risk of cancer.

Researchers have been studying the association between selenium and cancer<sup>18,19,20</sup> since the 1980s. Whitaker recounts his last year at Cornell University when a 10-year study began, evaluating supplementation with selenium and subsequent cancer development.<sup>21</sup>

Optimal cell functioning also depends on the amount of selenium and coenzyme Q10 available to the cells. In one interventional trial<sup>22</sup> involving selenium and CoQ10 as a dietary supplement, 443 participants from rural Sweden demonstrated a reduction in cardiovascular mortality using selenium and CoQ10 supplements over four years.

The researchers then followed up 12 years later and found the original participants continued to experience a reduction in cardiovascular mortality, as well as a reduced risk of high blood pressure, impaired functional heart capacity, ischemic heart disease and **diabetes**.<sup>23</sup> The leaders cautioned this was a small study that should be used to generate hypotheses and not conclusions.

Another study<sup>24</sup> enrolled individuals with worsening symptoms of heart failure to evaluate serum concentrations of selenium. They found selenium deficiency was associated with a higher rate of their primary endpoint of all-cause mortality and hospitalization for heart failure and that the deficiency was “independently associated with impaired tolerance and a 50% higher mortality rate ...”<sup>25</sup>

## **More Health Benefits Associated With Selenium**

Researchers are increasingly recognizing that a selenium deficiency is linked as a health risk to several conditions. For example, in a study published in BMC Musculoskeletal Disorders,<sup>26</sup> researchers evaluated the correlation between dietary selenium and **osteoporosis**. The study began with 6,267 subjects and the researchers found there was a higher rate of osteoporosis in individuals who had lower levels of selenium.

These results were replicated in a second study<sup>27</sup> that evaluated selenium levels against **bone mineral density**. The results remain statistically significant when confounding factors were accounted for, such as body mass index, smoking, physical performance and medication use.

Science has recognized the importance of selenium to men's fertility for many years. One study<sup>28</sup> showed supplementation could increase sperm motility in 56% of the intervention group who had low levels of selenium. More recent information shows it also plays a vital role in women's fertility. One researcher from a study evaluating levels of selenium and reproduction commented:<sup>29</sup>

*"Our findings are important because they show that selenium and selenoproteins are at elevated levels in large, healthy ovarian follicles. We suspect they play a critical role as an antioxidant during the late stages of follicle development, helping to lead to a healthy environment for the egg.*

*Infertility is a significant problem in our society. Further research is needed to better understand how selenium levels could be optimized, helping to improve women's chances of conceiving. Too much selenium can also be toxic, so it isn't just a case of taking multiple supplements."*

## **Consider Food Sources to Optimize Selenium Levels**

In one study<sup>30</sup> of 491 elderly Danish individuals, researchers found supplementing with 300 µg of selenium over five years increased all-cause mortality rates, demonstrating the dangers of concluding that if a little is good, more is better. This approach can frequently backfire when it comes to supplements and even foods.

Although it is difficult to get too much selenium from foods, the same is not true for supplements. Selenium toxicity<sup>31</sup> is a health risk that's linked to ingesting too much selenium that can trigger nausea and vomiting, abdominal pain, irritability, fast heart rate and lung lesions. Chronic exposure can also lead to baldness, excessive tooth decay, lack of mental alertness, fatigue and weakness.

As a general rule, eating a variety of whole, unprocessed foods can help to naturally optimize your selenium levels, as well as other important nutrients. An excellent selenium food source<sup>32</sup> is Brazil nuts, which average about 68 µg to 91 µg per nut. Other good food sources include pasture-raised organic chicken and turkey, sunflower seeds, pasture-raised organic eggs, mushrooms and sardines.

## Sources and Reference

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