

# The Secret of Zinc's Immunity-Boosting Power Revealed

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › Zinc has been acknowledged as an essential mineral for human health since the 1970s. More than 300 enzymes in your body require zinc for normal function, and it's well-recognized for its role in immunity and normal immune system development
- › A March 2022 study has now shed new light on how zinc influences immune function. Zinc is required for the development of disease-fighting T cells, and for the regeneration of your thymus, which produces T cells
- › A molecule inside your cells called GPR39 acts as a sensor that tracks changes in external zinc, and when the level rises, GPR39 triggers the release of a key renewal factor and thymic regeneration
- › Zinc ionophores, which act as a shuttle to transport the zinc into the cell, improves zinc uptake. Zinc ionophores include hydroxychloroquine (HCQ), chloroquine, quercetin and epigallocatechin gallate (EGCG)
- › Excessive zinc supplementation can cause an imbalance in your zinc-to-copper ratio, which can impair immune function. Copper, in turn, is interdependent on iron

Zinc has been acknowledged as an essential mineral for human health since the 1970s.<sup>1</sup> It's the second most abundant trace mineral found in the human body,<sup>2</sup> but your body cannot store it very well, so you need to consume foods with zinc every day to meet your body's needs.

More than 300 enzymes in your body require zinc for normal function,<sup>3</sup> and it's well-recognized for its role in immunity and normal immune system development.<sup>4</sup>

Research in the last decade has identified the crucial role that zinc plays in curtailing the length and severity of upper respiratory infections in particular. For example, a meta-analysis<sup>5</sup> published in 2017 found those who took a zinc supplement of 80 to 92 milligrams (mg) each day at the beginning of cold symptoms saw a reduction in the length of their cold by 33%.

Research published in 2020 also demonstrated that zinc is crucial to immune system function, and that deficiency can raise your risk of severe COVID-19 illness.<sup>6</sup> Early on in the pandemic, a number of doctors who were treating COVID patients recognized the importance of zinc and published early treatment guidelines that included it.<sup>7,8,9</sup>

## How Zinc Influences Your Immune Function

Zinc affects your immune function and helps prevent infections in a variety of ways. For example, data have shown:<sup>10</sup>

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People who are deficient in zinc have an increased susceptibility to pathogens, as zinc helps prevent viruses from entering<sup>11</sup> and replicating<sup>12</sup> inside your cells.

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Zinc mediates nonspecific immunity, including natural killer cells and neutrophils.

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Zinc deficiency prevents the activation of T-lymphocytes, production of Th1 cytokine, and the ability of B lymphocytes to help. During deficiency, B lymphocyte development is also compromised.

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Deficiency affects the function of macrophage cells, which can trigger cytokine production<sup>13</sup> and dysregulated intracellular death. Thus, with a deficiency in zinc, you not only get more viral infections, but these trigger an increase in the hyper inflammatory response.

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Zinc is central to DNA replication, RNA transcription and cell activation and division.

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Zinc supports growth and function of ciliary hairs in your respiratory system. One study published in the American Journal of Rhinology and Allergy<sup>14</sup> showed zinc stimulates ciliary beat frequency and may help improve mucociliary clearance, which is essential for clearing the lungs of mucous. Another group of scientists found that supplementing animals deficient in zinc affected the length of the cilia and number of epithelial cells in the bronchus.<sup>15</sup>

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Zinc also improves your respiratory epithelial barrier.<sup>16,17</sup>

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Zinc influences interferon-gamma (IFN- $\gamma$ ), which plays a significant role in defending against intracellular pathogens.<sup>18</sup> When there is a reduction in this cytokine, your immune function will be impaired.

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## **Zinc Helps Immune System Regrow Immune Cells**

A March 2022 study has now shed new light on how zinc influences immune function. As reported by Science Daily:<sup>19</sup>

*“In a new study published online March 25 in the journal Blood, Fred Hutchinson Cancer Research Center scientists reveal two ways the mineral supports immunity and suggest how it could be used to improve health.*

*Using mice, the team discovered that zinc is needed for the development of disease-fighting immune cells called T cells and prompts regeneration of the thymus, the immune organ that produces T cells.*

*‘This study adds to our knowledge of what zinc is actually doing in the immune system and suggests a new therapeutic strategy for improving recovery of the immune system,’ said senior author Dr. Jarrod Dudakov, an immunologist at Fred Hutch ...*

*As in humans, Iovino and Dudakov found that the thymuses of mice deprived of dietary zinc shrink and produce notably fewer mature T cells, even after as little as three weeks of a no-zinc diet. Iovino was able to show that without zinc, T cells cannot fully mature.*

*He also found that zinc deficiency slows recovery of T-cell numbers after mice receive immune-destroying treatments akin to those given to patients about to receive a blood stem cell transplant. Conversely, extra zinc speeds this process, and T cells recover faster than normal."*

When zinc external to the cells rises, the cells release a regenerative factor that triggers renewal inside the thymus. T cells accumulate zinc as they develop, but when killed by a burst of radiation (or other damaging event), that zinc is released, raising the external zinc level.

**“ A molecule inside your cells called GPR39 acts as a sensor that tracks changes in external zinc, and when the level rises, GPR39 triggers renewal factor release and thymic regeneration. ”**

A molecule inside your cells called GPR39 acts as a sensor that tracks changes in external zinc, and when the level rises, GPR39 triggers renewal factor release and thymic regeneration. The researchers also found they could trigger this regenerative process using a novel compound that mimics rising zinc levels. Dudakov explained:<sup>20</sup>

*"What we think is going on is, as you give zinc supplementation, that gets accumulated within the developing T cells. It gets stored and stored and stored, then the damage comes along and the zinc is released.*

*Now you have more zinc than you normally would, and it can instigate this regenerative pathway. With the experimental compound we can just directly*

*target GPR39 and basically get the same effect without any of that pretreatment."*

## **Zinc Ionophores Improve Zinc's Effectiveness**

While zinc is a crucial mineral for normal immune function, supplemental zinc is not very bioavailable. So, to improve zinc uptake into the cell, a zinc ionophore can be very useful. Zinc ionophores basically act as shuttles that transport the zinc through the cellular membrane into the cell, and getting the zinc into the cell is crucial for stopping viral replication.

Zinc ionophores that have received a lot of exposure in alternative media over the past two years are hydroxychloroquine (HCQ), chloroquine, quercetin and epigallocatechin gallate (EGCG).<sup>21</sup> Chances are you've heard of HCQ being used for COVID-19, but the real key in early treatment protocols that use HCQ is really the zinc. The primary role of the HCQ is to boost zinc uptake in the cell.

Quercetin, which is a natural supplement, also shuttles zinc but has antiviral,<sup>22,23,24,25,26,27,28,29,30</sup> anti-blood clotting, anti-inflammatory and antioxidant properties in addition to that.<sup>31</sup> Quercetin has also been shown to inhibit binding of spike protein to ACE-2 receptors, thereby blocking the ability of SARS-CoV-2 to infect human cells.<sup>32</sup>

Importantly, quercetin increases mitochondrial biogenesis in skeletal muscle, which suggests part of its antiviral effects are due to enhanced mitochondrial antiviral signaling.<sup>33</sup> By attenuating oxidative damage, it also lowers your risk of secondary bacterial infections,<sup>34</sup> which is actually the primary cause of influenza-related deaths.

When HCQ was banned from use for COVID, many wisely turned to quercetin, which is available over the counter. A number of studies have shown quercetin, when used early, lowers your risk of hospitalization and death from COVID,<sup>35</sup> and improves clinical outcomes.<sup>36</sup>

## **Beware, Zinc Supplementation May Trigger a Copper Imbalance**

For all its benefits, more is not better when it comes to zinc supplementation. In fact, it can backfire if you fail to maintain a healthy zinc-to-copper ratio.

As noted by Chris Masterjohn, who has a Ph.D. in nutritional sciences,<sup>37</sup> in an article<sup>38</sup> and series of Twitter posts,<sup>39</sup> “acceptable ratios of zinc-to-copper range from 2-to-1 to 15-to-1 in favor of zinc. Copper appears safe to consume up to a maximum of 10 mg/d” and “the maximum amount of zinc one could consume while staying in the acceptable range of zinc-to-copper ratios and also staying within the upper limit for copper is 150 mg/d.”

Zinc intake at doses between 150 mg and 300 mg per day has been shown to decrease markers of immune function, Masterjohn warns, and it’s “quite possible that the harmful effect of 300 mg/d zinc on the lymphocyte stimulation index is mediated mostly or completely by induction of copper deficiency.”

Even intakes of 60 mg of zinc per day has been shown to lower superoxide dismutase activity, an enzyme that is important to antioxidant defense and immune function and depends both on zinc and copper for normal function.

So, a key thing to remember is that your zinc level is also impacted by your copper level, and an imbalance in this ratio can lead to health problems. The best way to readily achieve proper balance is to get your minerals from real food grown in healthy nutrient-rich soils.

## **Do You Need More Zinc?**

That said, zinc deficiency is common. Experts believe that about 17.3% of the global population are deficient<sup>40</sup> and it is estimated most people over 65 consume just 50% of the recommended amount.<sup>41</sup>

This deficit may in part be the result of soil depletion of zinc due to conventional farming methods and may also simply be that not enough zinc-rich foods are included in the diet. Severe deficiency, however, is rare,<sup>42</sup> and often associated with an inherited condition called acrodermatitis enteropathica.

Common signs<sup>43</sup> your body may need more zinc include lack of appetite, mental lethargy, impaired sense of taste or smell, frequent colds, flu or infections, hair loss<sup>44</sup> and poor neurological function.<sup>45</sup> Individuals at higher risk for zinc deficiency include those with malnutrition, persistent diarrhea,<sup>46</sup> the elderly, people with inflammatory or autoimmune diseases, chronic alcoholics, vegetarians and vegans.<sup>47</sup>

Although it may be necessary to supplement during illness when your body needs more zinc, I recommend trying to meet your daily requirement from foods. Foods rich in zinc include:<sup>48,49,50</sup>

Alaskan King crab	Oysters	Almonds	Cashews
Kidney beans	Pastured chicken	Lamb	Chickpeas
Oatmeal	Grass fed beef	Cheddar or Swiss cheese	Yogurt
Mushrooms	Spinach	Pork chops	Pumpkin seeds

Personally, I would be very cautious about taking more than 15 mg of zinc per day by supplement. If you are consuming large amounts of animal foods like beef, you may not even need any, as animal foods (see table above) are typically loaded with zinc, especially organ meats.

I eat about three-fourths of a pound of ground bison a day, which has 20 mg of zinc. I personally don't take any zinc supplement other than what I get from my food, which is likely an optimal form to maximize absorption.

If you opt for a supplement, Masterjohn recommends taking 7 mg to 15 mg of zinc four times a day, ideally on an empty stomach, or with a phytate-free food.<sup>51</sup> The recommended dietary allowance in the U.S. is 11 mg for adult men and 8 mg for adult women, with slightly higher doses recommended for pregnant and breastfeeding women,<sup>52</sup> so we're not talking about taking significantly higher dosages.

He also recommends getting at least 1 mg of copper from food and supplements for every 15 mg of zinc you take.<sup>53</sup> It's best to get your copper from food and not a supplement.

Good sources include oysters, grass fed beef liver and other organ meats. Whole food vitamin C can also be helpful, as vitamin C contains an enzyme called tyrosinase, which has two copper atoms in it. Acerola cherry is one excellent source. You also want plenty of saturated fats in your diet, as copper is a fat-soluble mineral. If you don't have fat in your diet, your ability to absorb copper plummets.

## **Mind Your Copper-to-Iron Ratio Too**

Copper is also highly interdependent on iron and need to be considered together. If you don't have enough copper in your diet, hemoglobin production becomes impaired, along with many other aspects of iron metabolism. So, being anemic does not automatically mean that you're iron deficient. You may be deficient in copper. Anemia typically relates to iron dysfunction or dysregulation, not deficiency.

This interdependence, and the role of copper and iron on your mitochondrial energy production, was discussed at length in a recent interview with Morley Robbins, MBA, CHC,<sup>54</sup> author of "Cu-RE Your Fatigue: The Root Cause and How to Fix It on Your Own." I've included that interview above.

The common misconception that anemia is always the result of insufficient iron is tragic, as excess iron increases oxidative stress and causes metabolic dysfunction. As explained by Robbins, your mitochondria are not just making energy. They are also crucial recycling centers. Iron needs to be recycled through the mitochondria into either heme or iron sulfur clusters, and both also require copper in the conversion.

Inside your body, the ideal ratio of iron-to-copper is, on average, 50-to-1. Ideally, you would have about 5,000 mg of iron and about 100 mg of copper in your body.

## **Most People Have Elevated Iron**

The fact of the matter is, most men and postmenopausal women have excessive iron and can benefit from regular blood donation. As explained by Robbins, you accumulate about 1 mg of iron every day (based on the research of leading Iron biologists), and unless you lose blood, you retain that amount. By the time you are 65, you may have accumulated over 20,000 mg of storage iron.

So, again, more often than not, anemia (characterized as low serum iron and low serum ferritin) is not a sign of insufficient iron but rather a sign that the iron is not being properly recycled due to insufficient copper.

This storage iron will radically increase the oxidative stress and tissue damage in your body. It also is one of the most common causes of fatigue because of how it impairs the mitochondrial production of energy.

When you donate a pint or half-liter of blood, you remove approximately 250 mg of iron from your tissue iron. Donating four pints a year is far more than most people do, but you can see that if you had 20,000 mg of storage iron, it would take you 20 years of donating blood four times a year to get it down to a healthy level.

While regular blood donation is a highly effective way to lower your iron, losing 10% of your blood in one sitting can be a problem for many. It's easier on your system to remove blood in smaller amounts once a month on the schedule I have listed below. If you have congestive heart failure or severe COPD, you should discuss this with your doctor, but otherwise this is a fairly appropriate recommendation for most.

Men	150 ml
Postmenopausal Women	100 ml
Premenopausal Women	50 ml

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