

How to Help Prevent a Cytokine Storm

Analysis by [Dr. Joseph Mercola](#) ✓ Fact Checked

STORY AT-A-GLANCE

- › Part of what makes COVID-19 such a dangerous disease in severe cases is because it can trigger a cytokine storm reaction leading to sepsis, organ failure and death
- › Astaxanthin, a potent antioxidant supplement derived from microalgae, has many health effects that render it an ideal candidate as an adjunct therapy against COVID-19
- › Astaxanthin is a powerful antioxidant, immune booster, anti-inflammatory, neuroprotector and immunomodulatory with antibacterial and anti-apoptotic effects
- › Astaxanthin blocks oxidative DNA damage, lowers C-reactive protein and other inflammation biomarkers, inhibits cell death in alveolar epithelial cells, modulates the immune response and much more
- › Studies have shown it alleviates cytokine storms, acute lung injury, acute respiratory syndrome and sepsis, all of which are common in cases of serious COVID-19 infection

This article was previously published May 11, 2020, and has been updated with new information.

Part of what makes COVID-19 such a dangerous disease in severe cases is because it can trigger a cytokine storm reaction leading to sepsis, organ failure and death.

I've written a number of articles discussing a variety of natural supplements known to inactivate viruses, quell inflammation and regulate the inflammatory process. Examples

include vitamin C, melatonin and licorice root. You can find them all on my Coronavirus Resource Page.

Blocking Cytokine Storm Is Crucial

Most recently, the paper¹ "COVID-19: Potential of Microalgae Derived Natural Astaxanthin as Adjunctive Supplement in Alleviating Cytokine Storm," published April 21, 2020, on the research library website SSRN, addresses the use of astaxanthin, a potent antioxidant supplement derived from microalgae. According to the authors:

"There is rationale, pre-clinical evidences of effectiveness and evidence of safety from long-time use for other indications to justify possible inclusion of natural astaxanthin as adjunctive in combination with primary anti-viral drugs therapy will hugely benefit COVID-19 patients by improving their health and reducing recovery time ...

Clinically, natural astaxanthin has shown diverse benefits with excellent safety and reported to block oxidative DNA damage, lowered C-reactive protein (CRP) and other inflammation biomarkers. Previous studies reported that natural astaxanthin exert positive effects in alleviating cytokine storm, acute lung injury, acute respiratory syndrome, etc ...

Current understandings based on accumulated evidences suggest that SARS-CoV-2 induces a potential amplified inflammatory response to sequential consequences of ALI [acute lung injury], ARDS [acute respiratory distress syndrome] to a life-threatening dire consequence of potential septic shock with elevated expression of inflammatory related genes along with inevitable secondary infections, rather than increased viral load ...

The attenuation of the cytokine storm by targeting key steps in the process may deliver improved outcomes ... Shi et al. suggested a two-phase approach for potential treatments of COVID-19 patients: the first immune defense-based

protective phase for non-severe COVID-19 cases and the second, inflammation-driven damaging phase for severe COVID-19 patients.

Zhang et al. presented a critical review ... stating that blocking the cytokine storm at right time followed by initiation of anti-inflammation therapy is very critical for reducing the rate of fatalities. ... A range of antioxidants as supplements will offer a window of quick recovery of patients by reducing post treatment side-effects."

Rationale for Using Astaxanthin

The astaxanthin paper cites research showing astaxanthin "can play major roles in regulating immunity and disease etiology" thanks to its multifaceted activity. Not only is it a powerful antioxidant, but it's also an immune booster, anti-inflammatory, neuroprotector, immunomodulator, antibacterial and anti-apoptotic. In terms of antioxidant power, it's thought to be the most potent available. As noted in the astaxanthin paper:²

"The antioxidant activity of astaxanthin is reported to far exceed the existing antioxidants with ROS- scavenging capacity of 6,000 times that of vitamin C, 800 times that of coenzyme Q10, 550 times that of vitamin E, 200 times that of polyphenols, 150 times that of anthocyanins, and 75 times that of α -Lipoic acid."

Importantly, as explained in this paper, astaxanthin has a very unique molecular structure that allows it to penetrate the bilayer membrane of cells. The ability to quench reactive oxygen species (ROS) and free radicals in both the inner and outer layers of the cellular membrane allows it to provide superior protection against oxidative stress, compared to other antioxidants.

Vitamin E and beta-carotene, for example, only work in the inner side of the membrane, and vitamin C only works on the outer side.³ What's more:

"The anti-oxidative effect of astaxanthin cooperates with its anti-inflammatory actions by up-regulating anti-oxidative enzymes (e.g. superoxide dismutase)

and down-regulating pro-oxidative enzymes (e.g. nitric oxide synthetase).

Astaxanthin is also known to protect pancreatic beta cells by reducing oxidative stress and sugar toxicity, improve the levels adiponectin and HDL, and enhances blood flow and circulation," the authors state, adding:

"Increasing evidences indicate that dysregulation of cytokines in acute inflammation is the most important step in mediating, amplifying and perpetuating the process of sepsis or ALI ...

The excessive release of various pro-inflammatory cytokines mainly including TNF- α , IL-6, IL-1 β , IL-12 and IL-8 rapidly initiate a systemic inflammatory response leading to simulation of adaptive immune response and cytokine storm resulting the acute cellular injury to form sepsis or ALI.

These observations along with currently accumulating evidences related to COVID-19, strongly suggest that the inflammatory process involve in association with ARDS related ALI and sepsis.

This warrants that effective anti-oxidant and anti-inflammatory treatments must be given strategically to treat COVID-19 patients ...

Anti-inflammatory / anti-oxidants candidates to intervene the excessive production of cytokines, including IL6 and TNF- α can be a promising strategy for the prevention and treatment of COVID-19 induced ARDS related ALI and sepsis."

According to the authors, astaxanthin may be uniquely suited for this task. Astaxanthin, "with its proven anti-inflammatory and antioxidant activity backed by multiple preclinical and human trials and with its extraordinary safety profile can be one of the most promising candidates to be tried against COVID-19," they say.

How Astaxanthin May Inhibit SARS-CoV-2 Damage

The authors believe astaxanthin may help minimize the impact of SARS-CoV-2 infection by:⁴

Inhibiting nuclear factor kappa-B (NF- κ B), a transcription signaling pathway involved in the innate immune response. This reduces the M1/M2 macrophage phenotype ratio, which is an important part of lowering levels of inflammatory cytokines.

NF- κ B is also a mediator of inflammation in acute lung injury, and according to the authors, "Previous studies reported that the anti-inflammatory effect of [astaxanthin] involves the suppression of NF κ B activation in ARDS"

Inhibiting production of IL6, a key culprit in sepsis, acute lung injury and ARDS

Inhibiting production of TNF-alpha, which decreases the levels of several proinflammatory cytokines

Inhibiting apoptosis (cell death) in alveolar epithelial cells

Increasing Sirtuin 1 (SIRT1), which according to the authors "can play a vital role in proper regulation of SIRT1 to attenuate lung injury and inflammation" in sepsis-induced acute lung injury

Inhibiting the Toll-like receptor 4 (TLR 4) signaling pathway, which reduces the pro-inflammatory response. As noted by the authors, "TLRs are a group of pattern recognition receptors that play a critical role in the innate immune system"

Decreasing alveolar wall swelling

Significantly inhibiting bronchial alveolar lavage fluid in acute lung injury and suppressing lung edema

Reducing the decline in pulmonary alveoli in lung tissue

Modulating the immune response by stimulating lymphocyte proliferation (a type of

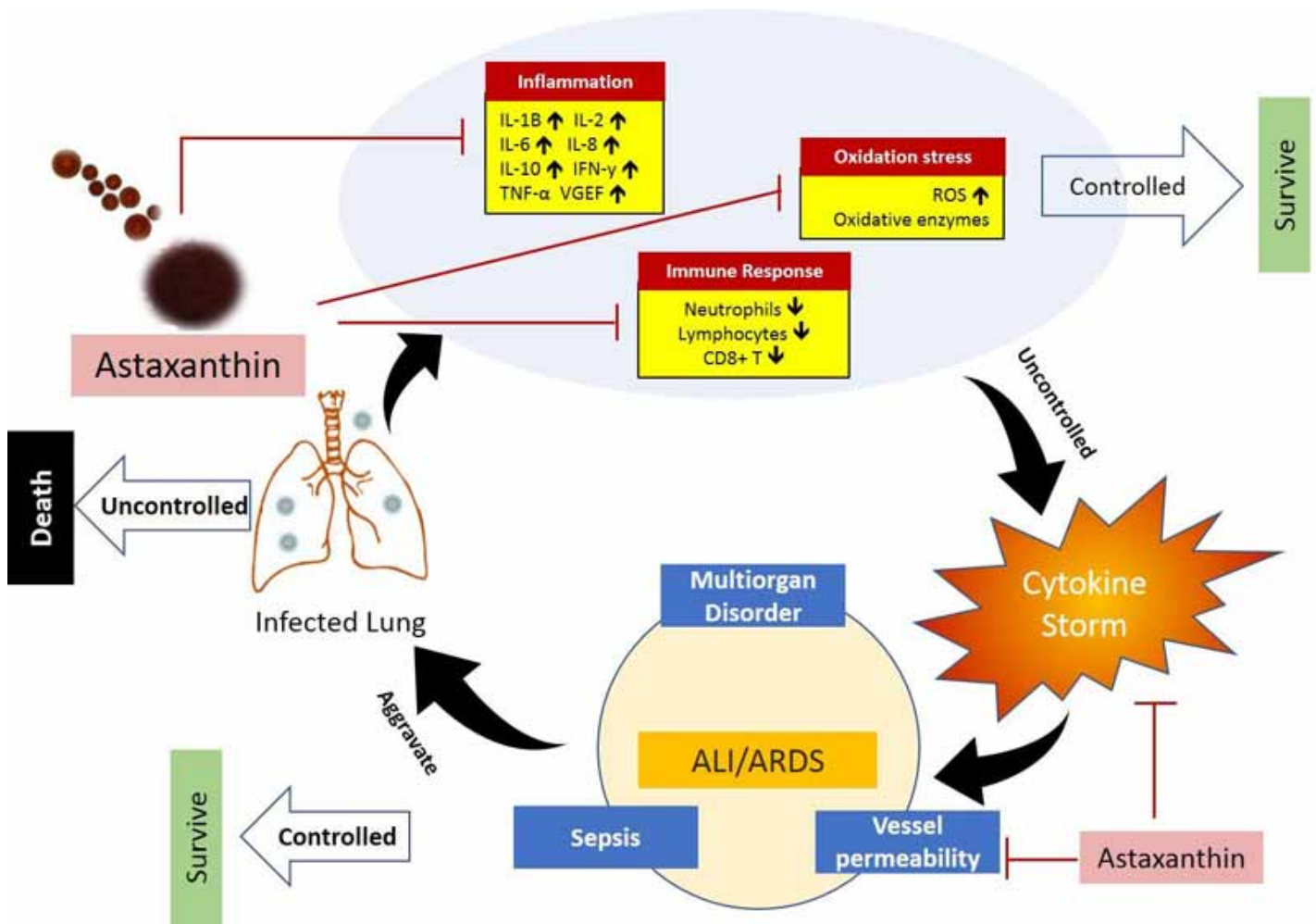
white blood cell involved in fighting infections), increasing natural killer cell cytotoxicity and increasing the number of T cells and B cells (two major components of your adaptive immune response)

Down-regulating NOD-like receptor 3 (NLRP3) inflammasome – which is part of your innate immune response during lung infection – and its downstream apoptosis and inflammatory response

Reducing C-reactive protein, a marker of inflammation

The following graph illustrates and summarizes the beneficial effects of astaxanthin and how it can help quench the cytokine storm response responsible for the sepsis, acute lung injury, ARDS and multiorgan disorders often seen in patients with severe COVID-19 disease. According to the authors:

"Taken together, we speculate that implications of astaxanthin as adjunctive countermeasure in the treatment of COVID-19 may exert dual purpose of both as antioxidant and anti-inflammatory compound with beneficial outcome of reduce fatality and rapid recovery ..."



Astaxanthin, One of Nature's Most Powerful Antioxidants

In short, astaxanthin ticks many important boxes when it comes to ameliorating COVID-19, including immune response regulation and the enhancement of both cell-mediated and humoral immune responses, as well as the simultaneous protection against oxidative damage and inflammation.

Aside from being potentially useful against COVID-19 and other respiratory illnesses, astaxanthin has also been shown to provide broad-spectrum, systemwide health benefits, protecting against radiation and promoting skin, eye, brain and heart health. To learn more about this powerful antioxidant, see "Research on Astaxanthin Demonstrates Significant Whole Body Benefits."

Sources and References

- ^{1, 2} SSRN April 21, 2020
- ³ SSRN April 21, 2020, 4.1. Astaxanthin as anti-oxidant and anti-inflammatory compound
- ⁴ SSRN April 21, 2020, Pages 7 through 11