

How Molecular Hydrogen Can Help Against COVID-19

Molecular hydrogen (H₂ gas) has powerful antioxidant and anti-inflammatory effects,¹ making it potentially useful for COVID-19, as explained in this video by Tyler W. LeBaron, founder of the science-based nonprofit Molecular Hydrogen Institute.

In his video, LeBaron reviews the pathophysiology of COVID-19 and explains why H₂ is being clinically investigated by discussing the proposed mechanisms of how molecular hydrogen might ameliorate this particular disease.

In fact, several Chinese investigators are using H₂ therapy in COVID-19 patients,^{2,3} and preliminary results^{4,5} are encouraging enough that Dr. Zhong Nanshan, the epidemiologist who discovered the SARS virus (SARS-CoV-1) in 2003, is now recommending H₂ therapy for COVID-19.⁶

While more research is needed to confirm benefits and beneficial outcomes in COVID-19 cases, the latest COVID-19 treatment guide⁷ by the Chinese National Health Commission includes hydrogen inhalation.

LeBaron includes a video clip of Chinese patients given a hydrogen-oxygen inhaler mix, who say it eliminated chest pain and cough, and allowed for deeper breathing without discomfort. That said, LeBaron notes:

"There is still no clinically published evidence that H₂ will truly benefit COVID-19 and this information is solely for educational purposes. It does not constitute clinical evidence, and is not intended to replace the guidance from your health care practitioner."

Pathophysiology of COVID-19

As explained by LeBaron, the SARS-CoV-2 virus responsible for COVID-19 enters the lungs, where it attacks the type 2 pneumocytes,⁸ alveolar cells responsible for the secretion of surfactants that reduce the surface tension of fluids in your lungs and are thus important for elasticity.

The SARS-CoV-2 virus uses a spiked protein to anchor itself to the ACE-2 receptor⁹ of the cell. This is how it gains entry and releases its positive-sense single-strand RNA into the cell. By inserting its RNA, the virus essentially hijacks the cell, as it triggers viral replication to occur inside the cell.

In response, macrophages (white blood cells) are activated to combat the infection, and they in turn release a variety of cytokines, including interleukin-6 (IL-6), IL-1 and TNF-alpha, into your blood plasma. Once the cytokines enter your plasma, neutrophils are recruited, thus increasing vasodilation (expansion of your blood vessels) and capillary permeability.

Inside the cell, reactive oxygen species (ROS) are also created in an effort to kill the infected cell and prevent viral replication. This is an essential part of your body's defense system. However, as the process progresses you end up with increasing amounts of ROS and inflammation. Worse, as the virus continues to attack your type 2 pneumocytes, your lungs cannot work correctly.

As the surface tension of the fluids in your lungs is reduced, your alveoli can no longer maintain the proper gas exchange, and your oxygen requirement goes up. Declining elasticity of the lungs also makes breathing more difficult. Add in high amounts of ROS, and the whole alveoli ends up dying. This is part of what's causing the cough.

As inflammation and vasodilation progresses, you can end up with low blood pressure, which is why you feel fatigued and weak. Lower blood pressure also causes low blood perfusion, which in turn means your cells will not get the oxygen and nutrients they need for optimal function. It also impairs metabolic waste removal. The low oxygen levels (hypoxia) result in feeling short of breath.

Unless successfully treated, this chain of events leads to cell death, multi-system organ failure (lungs, liver and kidneys), acute respiratory distress (ARD) and, ultimately, death.

Stopping the Destructive Cycle

To save the patient, something needs to be done to stop this destructive cascade of events. How do we inhibit viral replication and boost immune system function? As

explained by LeBaron, most of the destruction occurs by ROS and systemic inflammation.

ROS are molecules that cause oxidative damage. However, they're not all bad all the time. Neutrophils that produce ROS also produce [nitric oxide](#) and superoxide, which are crucial. Superoxide helps kill the pathogen, but you also don't want too much of it, so it needs to be regulated.

Nitric oxide also needs to be regulated. While it can inhibit viral replication and helps boost your immune system, you don't want too much. As levels of superoxide and nitric oxide rise, they start forming peroxynitrites, which are extremely damaging, which in turn form hydroxyl radicals, the most cytotoxic ROS.

Normally, when superoxide has done its job, it's converted by superoxide dismutase into hydrogen peroxide, which in turn is converted into water and oxygen.

This process is regulated by a transcription factor called Nrf2/keap1. When this transcription factor is activated, it goes into the cell's nucleus, where it binds with the antioxidant response element (ARE), which triggers your body's natural antioxidants such as glutathione and catalase.

As noted by LeBaron, Nrf2, which is involved in phase 2 detoxification, regulates more than 200 protective proteins and enzymes. The problem is that when ROS is overabundant and out of control, the Nrf2 system is depleted and can no longer regulate the inflammatory process.

Understanding Molecular Hydrogen

[Molecular hydrogen](#) or H₂ has the ability to activate the Nrf2/keap1 pathway, thereby replenishing your endogenous antioxidants. In so doing, H₂ helps regulate and maintain homeostasis in the whole system, preventing the infection from getting out of control and causing cell death.

Hydrogen can also downregulate [NOX](#) and NOS enzymes, thus lowering superoxide and nitric oxide production respectively. This is good, as when these two molecules are increased too much they instantly combine to create the pernicious peroxynitrite

molecule. H₂ also supports your mitochondrial function. Importantly, H₂ selectively reduces peroxynitrites and hydroxyl radicals.

This gives H₂ a significant advantage over other antioxidants such as [vitamin C](#), which act indiscriminately with superoxide and nitric oxide, both of which also have important and beneficial functions. H₂ does not interact with either superoxide or nitric oxide. The only thing H₂ can react with are the most dangerous ROS such as peroxynitrites and hydroxyl radicals.¹⁰

As a result, your superoxide and nitric oxide are left to perform beneficial functions while the H₂ eliminates the most dangerous byproducts of superoxide and nitric oxide, while simultaneously increasing your body's natural production of antioxidants and regulating the enzymes that produce superoxide and nitric oxide. To get a clearer picture in your mind of how H₂ steps in to break the destructive chain, see LeBaron's video.

H₂ also steps in to prevent a cytokine storm from occurring. A cytokine storm occurs when the upregulation of cytokines is greater than your body can handle. Cytokines are regulated by transcription factors, and ROS regulate these transcription factors. Inflammatory transcription factors, in turn, create more inflammation, which stimulate more ROS production.

This is a vicious cycle that results in increased cell death, which leads to multiorgan failure, which leads to death. H₂ has been shown to regulate these transcription factors in several animal and human studies, thus breaking the vicious cycle. This is what makes H₂ so anti-inflammatory. As summarized by LeBaron at the end of his video:

"Hydrogen gas, being a very simple, small molecule, can help to regulate the redox status of the cell by selectively reducing the very bad [ROS], help to regulate and improve the Nrf2/keap1 pathway to maintain our body's redox homeostasis.

It also has regulatory effects on inflammation, to lower chronic, harmful systemic inflammation by regulating everything. Just decreasing or inhibiting it [referring to ROS] is not what we want to do. We need all of these things.

This is in our immune system. We don't just want to get rid of it. Yes, it is what is killing us, but it is also very important to have, so that we can get better. So, that is the rationale for [using hydrogen gas] for COVID-19."

Dosing and Availability

Although the specific clinical studies on COVID-19 are being conducted with H₂ inhalation, H₂ dissolved in water has been shown to be more effective than inhalation in other animal disease models.¹¹ Additionally, another article¹² suggests that the H₂-infused nitric oxide-producing beverage from H2Bev called HydroShot, should also be clinically investigated for its reported preliminary effects.

However, while there are various ways of getting H₂, the simplest and most practical delivery system is molecular hydrogen tablets that are dissolved in water. They are portable and can be taken anywhere, including travel and on airlines, and they consistently provide a high H₂ concentration. When using the tablets it's important to drink the water as soon as the tablets are dissolved and the water is still "white," as the H₂ dissipates quickly.

The [molecular hydrogen tablets](#) have the additional advantage of providing 80 mg of ionic elemental magnesium with each tablet. Magnesium can serve as a natural calcium channel blocker to help regulate high intracellular calcium levels that can wreak havoc in your body.

Also, the absolute quantity of H₂ is far less important than pulsing or creating an acute elevation of H₂ in your system over a short period. That acute elevation is what activates the Nrf2 pathway. When exposure is continuous, even if elevated, it has virtually no effect.

Clearly, we need more research to be better able to answer dosing questions, but in the interim, it seems customizing the dose to your personal circumstances would be most appropriate. So, if you're in normal, non-stressful circumstances at home, not really doing anything very stressful and not exercising much, maybe taking H₂ once a day is sufficient.

However, if you exercise a lot, you may want to take it two to three times a day to help reduce the oxidative stress from your exercise. Ditto if you're traveling and

exposing yourself to free radical stress from ionizing radiation at 35,000 feet. In such a circumstance, it might be appropriate to take it every two hours while you're in the air.

Considering their safety, ease of use, and beneficial effects on immune function and health, molecular hydrogen tablets are a no-brainer solution in my view, and they could be quite helpful for many conditions, including COVID-19, which is why H₂ is being clinically investigated.