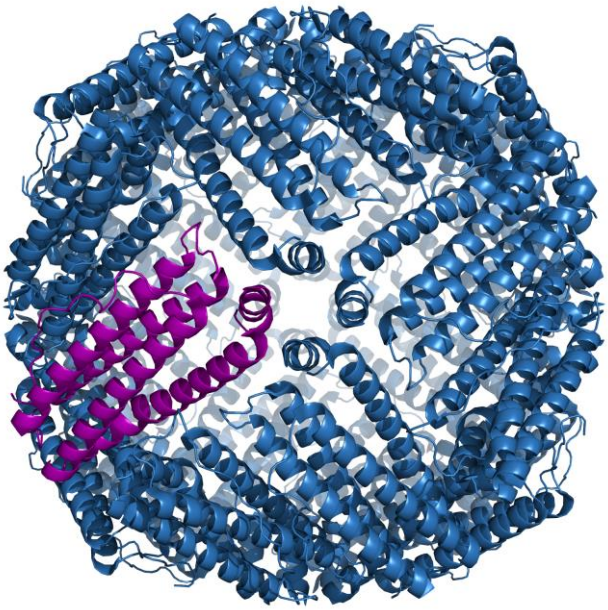
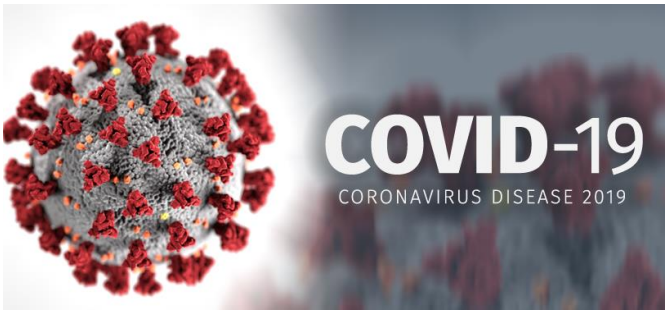
# **Ferritin - How it relates to COVID-19:** Edward Dong

Grade 8 Toronto On Canada Oct 11,2020.



## What is COVID-19?

Coronavirus disease 2019 (COVID-19), is a respiratory disease that is caused by Sars-Cov-2, and was recently discovered in Wuhan, China. During December of 2019, patients with pneumonia started showing up at hospitals, with unknown causes. This virus can be spread from human to human, and its symptoms are coughing, difficulty breathing, sneezing, runny nose, and symptoms similar to the flu. To people with weaker immune systems or have a history of hospitalizations because of other problems such as cancer, this virus may even cause death. This virus has seriously harmed the world's economy, forcing countries to shut down many of their schools, and businesses. On March 11th of 2020, the World Health Organization declared this new coronavirus as a pandemic.




## Virology and immunology

This recent coronavirus is the 7th coronavirus to be able to infect humans, and is in the same family as the SARS (Severe Acute Respiratory Syndrome), and MERS (Middle East Respiratory Syndrome). These three coronaviruses have caused deadly pneumonia to humans in

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the 21st century. The coronavirus is also enveloped and is a single stranded RNA virus. Experts believe that the virus was transmitted via cave bats to humans.

The response for this virus entering the human body is most likely to be a CD4+ Th1 and CD8+ T cell response, ending with viral clearance. In more serious cases, the response is delayed and there is an increased production of inflammatory cytokines, with a rush of monocytes and neutrophils to the lungs, resulting in a cytokine storm syndrome. Cytokines, along with several interleukins, may cause or support respiratory failure.

Another severe side effect that Covid-19 can cause is lymphopenia, as a result of bone marrow suppression or direct infection of lymphocytes.

IgM and IgG are usually found within 2 weeks of infection, but it is not known whether the previously infected can be re-diagnosed with the coronavirus.

The structure of Sars-Cov-2 is composed of non-structure and structure proteins, and the structure proteins include helical capsid made by nucleocapsid proteins that bind to the RNA genome, and an envelope made of membrane and envelope proteins, covered with spike (S) proteins. In order to make contact with its host, the virus uses the S protein to bind with our angiotensin-converting enzyme 2 (ACE-2) , which allows them to enter the host cell.

Currently, scientists have been working on testing some COVID 19 Vaccine's potential roles on humans.

But, there is only one current drug that may help as a treatment for COVID-19, and this drug is called Remdesivir. This drug is injected into the vein, and it is only used on patients with severe COVID-19 and it may help speed up the recovery time. Scientists have found that it can speed up a recovery from 15 days, to 11 days.(reference)

In clinical tests some cytokine and protein levels increase, including ferritin. Ferritin levels also increase in proportion to the severity of the case. In ICU patients with severe COVID-19, ferritin levels are shown to be very high. People with exceptionally high levels of ferritin, in 50% of cases people die. Knowing this, we can use ferritin as a biomarker for COVID-19.

## What is Ferritin?

Ferritin is a protein that contains iron. It helps regulate the level of iron in your body. Ferritin is also called major intracellular iron storage protein. Ferritin can bind free ions to trace elements, neutralizing toxic properties, including solubility. Regular levels of ferritin range between 12-300 nanograms per millilitre of blood in males, and 12-150 nanograms per millilitre of blood for females. Ferritin comprises 24 subunits. They are divided into heavy and light categories (FeH, FeL) subunits. (reference)

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## What happens if your ferritin levels are not normal?

The condition where you have high levels of ferritin is known as hyperferritinemia. It is abnormal for a male to have more than 300 nanograms of ferritin per mL, and abnormal for a female to have more than 150 nanograms. During hyperferritinemia, pro-inflammatory cytokines are released, which may cause death. This condition may be caused by genetic mutation, viruses and bacterial infections, diabetes, and can result in vision loss. Severe COVID-19 may benefit from immunomodulatory therapies. Ferritin activates macrophages, and macrophages are white blood cells that are part of the innate defense system in your body. They swallow bacteria and viruses that are not part of the body, or dead white blood cells. Macrophages are part of many white blood cells that make up the immune system. (reference,www. et al 2020)

Researchers indicate that if ferritin levels are too high, it is almost certain that you have viruses or bacteria in your body. For example, COVID-19, influenza, or liver disease. Low ferritin levels means low iron concentration and iron deficiency anaemia. It is abnormal for a person to have less than 12 nanograms of ferritin.

According to a source, a non-severe case of COVID-19 can cause ferritin levels to go up to 337.4(μg/L) and in severe cases, 1598.2 (μg/L), all at an average patient age of 51 and 63, respectively.

In conclusion, ferritin can be a very helpful biomarker for COVID-19 and other diseases, because the body will show high ferritin levels when a person has a severe sickness.

Reference:


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