



A Guide to Immunity; White Blood Cells, Antibodies and COVID-19

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The world has always been full of bacteria and viruses. Some can co-exist alongside our own cells and can even be beneficial to us. Unfortunately though, many infections can damage the host, and as our immune system fights, illness and even death can result. Such is the case with SARS-Cov-2, the virus that causes COVID-19. This article will explain how the immune system responds to this virus and what you can do to give yourself the best possible chance of winning the battle against this and other diseases.

At the most basic level, the best way to prevent transmission of any virus or bacteria is not to be exposed to it. This approach led to the shutting down of most non-essential services early last spring. But while social distancing and sanitizing are effective at reducing exposure to SARS-Cov-2, the unique situations that arise from working in the forestry industry may limit how well you can follow these guidelines. The good news is that even if you do have some exposure to a virus (or bacteria), your immune system has a finely tuned series of defenses designed to protect you, and the lifestyle choices you make can go a long way to keeping your immune system functioning at its best.

The Immune System is composed of two parts that work together to protect us. The first line of defense is the Innate System. This system is very important for fighting a novel virus like SARS-Cov-2 because it doesn't require any prior exposure in order to identify and attack the virus. The SARS-Cov-2 virus only evolved to infect humans in the past year, so most people have never been exposed to it before, and their immune systems can't 'recognize' it (more on this later).

The Innate system begins with a series of barriers, consisting of intact skin and mucous membranes that coat the nose and airways, digestive and urogenital tracts, and the surface of the eye. The skin and mucous membranes also produce enzymes and chemicals that act attack any invading organisms or infected cell, as well as activate the second part of the immune

system – the Adaptive System. So the first two points to put on your list of things to keep your immune system functioning in top form are; an intact barrier made up of undamaged skin - you could add a face mask and eye protection here, along with moisturizer and lip balm to prevent cracking of the skin with cold exposure, and two; things as simple as running a humidifier in dry cold climates. The high moisture level of the mucous membranes of the nose, throat and airways helps to trap particles in mucus secretions and remove them before they gain entry into lung cells. Avoiding smoking is also critical for maintaining healthy mucous membranes in the nose and throat. Any type of smoke and vapor are irritants, and nicotine paralyzes the tiny hair like cilia that sweep mucous and trapped particles away from the vulnerable lung tissue.

Certain cells of the Innate system act to help identify, isolate and kill infecting organisms. One type, called Natural Killer (NK) cells, recognize and attack virally infected cells (and those that have become cancerous). There's strong evidence that NK cells in people who exercise regularly are more effective, providing protection against cancer and upper respiratory tract infections. COVID-19 infection rates and severity of symptoms are lower in people who are physically fit. So put getting a minimum of 30 minutes of moderately intense exercise 5 days per week on your list of immune strengtheners. Keep in mind that most forestry workers do not meet this level of physical activity during a day of work, unless the day is spent hiking around the block. This might be surprising due to the fatigue you feel at the end of a long day, but it does mean that at least several times a week you need to actively seek out opportunities to get some more intense aerobic exercise if you want to keep your immune system functioning at its best.

The second and most powerful part of the Immune System is the Adaptive System, it learns to specifically recognize the shape of individual proteins on the bacteria or virus or infected cell, but it takes a week or two to mount its defense with a first exposure.

The big advantage of this system is that it remembers what the infections' proteins look like, allowing it to respond much faster the next time you are exposed to the same virus or bacteria. That way it can kill off the invading organism before it starts replicating and causes the disease. It's this fast response that can be created through a vaccine, thereby preventing diseases that cause serious effects like polio and measles – and hopefully soon for COVID-19 as well. By teaching your immune system to recognize the virus without experiencing the disease, it's the most powerful immune booster of all.

Adaptive System B cells produce antibodies that bind up viruses or bacteria, while different types of T-cells can kill infected cells or act to regulate the immune response. Every step of this process has also been shown to be stronger in people who exercise regularly, and impaired in people with metabolic syndrome and obesity and with aging – except in those who are fit! . So if you are looking for something that is truly proven to boost the immune system, put getting regular moderate exercise at the top of your list.

Because of the need to produce lots of immune cells, antibodies, and all kinds of proteins, it takes a fair bit of energy and material to mount an immune response. This means that making sure to get enough rest and nutrients is important to give your immune system it's best chance. Many studies have shown that getting enough sleep reduces inflammation and susceptibility to upper respiratory tract infections, so add 8 hours of rest nightly to your list of immune boosters. It may not be possible to achieve this goal all the time, but you can make getting a good sleep a priority during flu season or times like now, when we face the threat of a pandemic.

As far as diet is concerned, calories are a two edged sword. Glucose and the amino acid Glutamine are the preferred fuels for immune cells, so if you don't get enough carbohydrates or protein the immune system can't do its job. When blood

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glucose drops, the hormone Cortisol is released and acts to try and restore glucose levels. Body functions that are considered to be non-essential are blocked from using glucose, including cells of the immune system. Chronic stress also causes secretion of Cortisol and other hormones that are linked to lowered immunity. In contrast, excess calories (especially glucose) can increase inflammation, which has also been shown to lead to poor resistance to infections. Thus, two additional ways that you can give your immune system a boost are to manage your stress levels, and match your calorie intake to your output, with special attention to stabilizing blood glucose and getting enough protein. The best immune boosting diet is to avoid sugars, (especially in liquids), and choose unprocessed whole fruits, vegetables and grains for your carbohydrate sources. Combining proteins and moderate amounts of healthy fats with your carbs will also help to slow digestion and keep blood sugar more stable. It will also make sure you get enough protein and all the vitamins, minerals, antioxidants and other compounds that you need to mount a strong immune response.

Unfortunately, there is no clinical proof that supplementing with any product enhances immunity, unless a deficiency exists. Part of the problem is that the quality of many of these studies is poor, the supplements used in the studies tend to be pharmaceutical grade and quite different from those that are commercially available, the number of participants are often low and the duration short term. What seems to be initially promising rarely holds up under greater scrutiny. There are even cases where what was thought to be beneficial turns out to have negative effects, as has been found for high doses of antioxidants including Vitamin E. Iron is also toxic at higher amounts. There are however, a few cases where there is a clear link between increased risk of infections and low levels of a nutrient, such as for Vitamins D and A, glutamine, selenium and zinc – but taking more of these substances doesn't boost immunity, it's just that many people don't get enough of them, or that disease states might make you use more of them. There is some evidence that gut bacterial populations are important for health and immune function, but at this point in time, we just don't know enough about which probiotics help which populations. Hence, the only recommendations that are scientifically sound are to consume a fiber rich unprocessed diet, containing at least five servings of wide variety of fruits and vegetables daily, and whole grains, proteins and healthy fats in amounts appropriate for your energy needs. Some naturally fermented foods (brined or pickled without vinegar) should be consumed regularly, and food intake should be limited to less than 12 hours daily to encourage a healthy gut bacteria. If you can't follow this diet, a supplement with Vitamin A, selenium, zinc and copper should be considered. If sun exposure is limited, Vitamin D should also be supplemented.

The final dietary consideration is alcohol intake. Often an important part of the culture, it's easy for alcohol consumption to increase during the very times when peak immunity is needed. Social gatherings that involve alcohol also tend to reduce social distancing, and alcohol consumption has proven negative effects on both the Innate and Adaptive Immune Systems. If you do enjoy alcohol or the social situation encourages it, limit yourself to one or two servings of beer or red wine a couple of times a week. This amount of alcohol is low enough not to have a negative impact on your immunity, and there is some evidence that the polyphenols in red wine might even be beneficial.

In these uncertain times, making sure that we practice behaviors that are safe is critical to protect ourselves, our families, and our co-workers. Get enough rest, follow a diet similar to the Mediterranean or DASH diets, limit alcohol intake, stop smoking and get some exercise. Get yourself and your children vaccinated against serious diseases. Practice social distancing and sanitize your hands before eating or touching your mouth and nose and stay well! 🍌

Table 1. Recommended actions to maintain a healthy and effective immune system.

Protection	Action
Intact skin	<ul style="list-style-type: none"> Keep skin from cracking in the cold or dry Wear a suitable face mask Wear eye protection Avoid touching eyes, nose and mouth Sanitize hands, mask, eyewear and face frequently
Moist mucous membranes	<ul style="list-style-type: none"> Sleep with a humidifier in cold dry climates Stay hydrated
Stronger immune response, prevent loss of response with aging	Minimum 30 minutes of moderately intense exercise, 5 days per week.
Lowered chronic inflammation and suppression of immune response	Exercise and caloric restriction to achieve and maintain a healthy body weight
Reduced susceptibility to infections	Get 8 hours sleep nightly
Lower cortisol and other hormones that suppress the immune system	Use meditation and other techniques to manage mental stress
Stabilize blood glucose and ensure immune cells have the fuel they need to function	Adequate carbohydrate intake but avoid sugars so as to keep blood sugar stable
Provide vitamins and minerals, antioxidants and other nutraceuticals needed by the immune system.	Diet consisting of unprocessed fruits and vegetables, whole grains, healthy fats, adequate protein and high in fibre. Supplement with Vitamin D if exposure to sun is limited. Also consider supplementing with Vitamin A, selenium, zinc and copper if diet is limited
Maintain healthy gut flora	Consume live culture yogurt and other fermented products regularly. Limit food intake to 8-12 hours regularly. Choose foods rich in fibre
Avoid systemic inflammation and suppression of all steps in the immune response	Limit alcohol intake to no more than two servings per day
Maintain healthy mucous membranes	Do not use tobacco, vaping products or smoke marijuana
Build memory cells for long lasting immunity	Get vaccinated once clinically tested, safe, vaccines are available