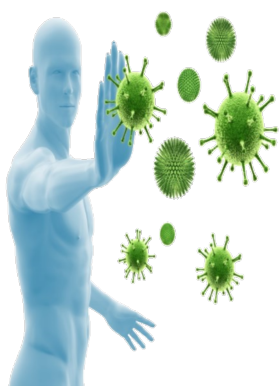


Nutrition & Immunity

By Haley
Snell-Sparapany, MS, RD,
ARCA Nutrition Services

Loretta Sesbeau, MS, LN
Prader-Willi Syndrome
Project Nutritionist

Introduction: I know there has been a lot of fear regarding the spread of COVID-19. With everything that we know about the virus, there is even more that we don't know. According to the available statistics and research from the CDC, our current understanding is that COVID-19 has a long incubation period, is spread easily from person to person through respiratory droplets and has a higher mortality rate than a typical flu. However, there is still a lot of contradicting information about this virus since it is so new, and much of our information is coming from what we know about different coronavirus strains. I mention this because current recommendations to stay healthy, like handwashing and social distancing, are not new and are based off what we already know about similar viruses. Likewise, while there hasn't been time to determine how nutrition can specifically impact COVID-19, there have been studies demonstrating how nutrition can influence immunity in general. So, let's discuss immunity and how nutrition can benefit us during the COVID-19 crisis.



Immunity: a system within our bodies composed of cells and other components that interact to maintain defense against infection. The immune system can be divided into two categories: innate and adaptive immunity. Innate immunity is the immunity you have when you're born and it consists of barriers, such as skin, as well as some chemical components. Adaptive immunity is when the immune system creates antibodies to fight off specific infections once they are introduced for the first time. Adaptive immunity is why vaccines work and why you would typically only get the chicken pox once in your life. There are many aspects of the body that make up the immune system. The skin is a large component of the immune system, as it acts as a barrier preventing microorganisms from entering the body. The cells in our intestine act as a barrier to microorganisms that we happen to ingest. If microorganisms enter our bloodstream, a collection of white blood cells work to attack these invading organisms. White blood cells are comprised of cells like phagocytes to engulf invading microorganisms, B-cells, which make up antibodies, T-cells, which destroy infected cells, and more. If an individual is undernourished, the cells related to immunity begin to break down, making the body more accessible to microorganisms.

Nutrients need other nutrients: it's commonly thought that specific nutrients are solely responsible for certain body functions. For example, we often hear about calcium and bone health, vitamin B12 and energy, and of course vitamin C and immunity. While it is correct that these vitamins and minerals play a role in these functions, that is not their sole responsibility in the body, and for these body functions to work properly, more nutrients are involved in the process. For instance, calcium is not adequately absorbed in the body without the assistance of vitamin D, and bone health is determined not only through calcium consumption, but there needs to be a balance of calcium, phosphorous, magnesium, and more. In addition, we know that exercise also plays a role in bone health. Overall, our body functions through a balance of metabolic processes made possible by various nutrients and can be further manipulated by our interactions with the environment.



Variety, balance & PWS: a balanced diet providing a wide range of macronutrients (protein, carbohydrate and fat) and micronutrients (vitamins and minerals) is going to be necessary for immunity to be working at maximum potential. This is why a wide variety of nutritious foods is essential in a PWS diet. A PWS diet is lower in calories, and amplifying nutrition is important. In a PWS diet, you would just serve a smaller portion of the nutritious food item. For example, half a piece of fruit. Also, this is why omitting whole foods like carbohydrates could be potentially detrimental to your health. Remember, it is not only about weight loss/maintenance it is also about health. In a PWS diet you can really maximize variety by offering a bunch of different kinds of fruit like blueberries, strawberries, watermelon, oranges, kiwi, grapes or a wide variety of veggies like carrots, broccoli, red peppers, celery, cucumbers, beets, cabbage, kale. This is an important concept to remember, because in this article, I'm going to be narrowing the focus to some key nutrients that play a vital part in immunity, but even if you were to take mega-doses of these nutrients, your body won't be able to adequately use them if you are suffering from other nutritional deficiencies. Keeping this in mind, let's go ahead and touch on some specific nutrients that play a crucial part in the synthesis, growth, development, and activity of immune cells, starting with the most recognized one.

Vitamin C is important for wound healing and skin integrity as it increases the cross connections between the amino acids in collagen. Vitamin C affects our internal immunity by regulating the gene expression for white blood cells that function in phagocytosis. Phagocytes are cells that engulf microorganisms as a mechanism to remove pathogens from the bloodstream, and vitamin C can improve the effectiveness of these cells. Vitamin C has also been shown to enhance differentiation and proliferations of T-cells and B-cells, which are important in the formation of antibodies. From this, we can extrapolate that vitamin C can lessen our susceptibility to illnesses, including COVID-19. Research has suggested that vitamin C can reduce the severity of symptoms from an upper respiratory infection. As an antioxidant, it is suspected that the anti-inflammatory effect of vitamin C is the reason why upper respiratory symptoms may be suppressed. We learned from the CDC that the main complications of COVID-19 relate to the upper respiratory system, so vitamin C has the potential to mitigate the severity of symptoms from coronavirus. You can increase your intake of vitamin C by consuming citrus fruits, strawberries, bell peppers, brussels sprouts, and broccoli.

Vitamin D is tied to the signaling of macrophages, an important phagocyte that engulfs foreign microorganisms to be expelled from the body. Vitamin D deficiency has in fact been tied to asthma, which we know increases susceptibility and mortality from COVID-19. In fact, some studies showed that Vitamin D deficiency increases susceptibility to various types of coronavirus. Vitamin D deficiency is common, because it unfortunately isn't in a wide variety of foods, apart from fortified dairy products, and during colder seasons, we often don't synthesize enough from the sun. This is one reason why dairy is so important in our diet.

Vitamin A is crucial for maximizing the integrity of the skin. It aids in the development of immature epithelial cells into the mature epithelial cells of the skin, lungs, intestinal lining, and stomach. Vitamin A plays a role in the skin's ability to secrete lysozyme, an enzyme that kills bacteria on the skin. Vitamin A has also been shown to aid in the differentiation and development of T-cell-dependent antibody responses. T-lymphocytes are crucial for immunity among intestinal cells in particular. The various T-cells signal different stages of the inflammatory response to infection, which includes an anti-inflammatory aspect. If deficient in vitamin A, T-cells will signal appropriate inflammatory markers, but they will not effectively differentiate into T-cells responsible for attenuating the inflammation. This leads to an excessive inflammatory response, which can cause damage to tissues. Overall, adequate vitamin A has been proven to decrease the morbidity and mortality of diseases. Vitamin A is rich in liver, sweet potatoes, spinach, mangos, carrots, kale, peaches, apricots and fruits and veggies that are orange in color.

Vitamin E is imbedded in the membrane of immune cells. As an antioxidant, it prevents oxidative damage to immune cells. Foods rich in vitamin E include almonds, peanuts, sunflower seeds, olive oil, avocado, spinach, broccoli, and

Protein Amino acids are the building blocks essential for the growth and maintenance of various tissues. Without adequate protein, your body lacks the materials needed to make various immune cells and antibodies, which bind to foreign proteins in the body to trigger the removal of invading microorganisms. In numerous studies, protein malnutrition has been proven to impair the immune system.

Zinc has a role in most stages of wound healing, from coagulation to membrane repair and tissue re-epithelization. Inadequate zinc will impede wound healing, lowering the skin's integrity and ability to keep harmful bacteria and viruses outside of the body. Apart from wound healing, zinc is important for the proper development of the white blood cells responsible for handling infections. Zinc deficiency reduces thymus hormone activity responsible for producing immune cells. Similar to vitamin E, zinc can help prevent oxidative damage to tissues, stabilizing the membranes of immune cells. Luckily, there are a lot of foods that are rich in zinc, especially high protein foods like meat, shellfish, legumes, nuts, seeds, dairy, and eggs.

These aren't the only nutrients needed for a healthy immune system. Vitamins B6, B12, and folate help maximize intestinal integrity, and minerals iron and copper are important for the synthesis of white blood cells. There is ample evidence showing that deficiency of these nutrients impedes immune function. You might have noticed that a lot of these vitamins and minerals have similar functions, from aiding in the development of white blood cells to protecting immune cells from oxidative damage. I do want to mention that even though these nutrients have similar overall functions in the immune system, the specific mechanisms related to cell signaling and gene expression for each nutrient is more complex and varied. The balance of inflammatory and anti-inflammatory processes is important for immunity, there are other things you can do during the stay at home order to help reduce general inflammation in your body. Aside from staying on a PWS diet, it is important to stay moving during this time. Being cooped up in your home can lead to sedentary behaviors which can impede and exacerbate weight gain. The extra weight gain, can lead to more inflammation within the body. Regular physical activity reduces overall inflammation and can keep you healthy and strong. Try a new exercise video or take a walk around the block using social distancing.

