

Short Communication**Immune Boosters- A Boon against COVID-19**

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**Received Date:** August 25, 2020

**Publication Date:** September 01, 2020

COVID-19 has rapidly affected our day to day life and demobilized the global economy. World trade is expected to fall by 13%-32% in 2020. Social distancing, self-isolation, and travel restrictions have caused a loss of jobs due to the decreasing workforce. COVID-19 is a disease caused by SARS-CoV-2, it causes respiratory tract infection, which affects the upper respiratory tract (sinuses, nose, and throat) or lower respiratory tract (windpipe and lungs). It spread is similar to other coronaviruses, mainly through person-to-person contact. Droplets are produced when an infected person coughs or sneezes, these contain the virus and form the main means of transmission. The spread occurs to people who are nearby (within 2 meters), through droplets inhaled into the lungs and by touching a surface, object, or the hand of an infected person. Infections range from mild to deadly (severe).

SARS-CoV-2 is one of seven types of coronavirus, including the ones that cause severe diseases like the Middle East respiratory syndrome (MERS) and sudden acute respiratory syndrome (SARS). The other coronaviruses cause most of the colds that affect us during the year but aren't a serious threat to otherwise healthy people. According to the WHO, COVID-19 affects different

people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. On average it takes 5–6 days from when someone is infected with the virus for symptoms to show, however it can take up to 14 days. The most common symptoms are fever, dry cough, and tiredness. While the fewer common symptoms are aches and pains, sore throat, diarrhea, conjunctivitis, headache, loss of taste or smell, a rash on the skin, and discoloration of fingers or toes. The severe symptoms appear to be difficulty breathing or shortness of breath, chest pain or pressure, and loss of speech or movement.

The virus can lead to pneumonia, respiratory failure, septic shock, and death. Many COVID-19 complications may be caused by a condition known as cytokine release syndrome or a cytokine storm. This is when an infection triggers your immune system to flood your bloodstream with inflammatory proteins called cytokines. These substances can kill tissue and damage organs. Immunity is a key factor against COVID-19. In the current pandemic of COVID-19, where no effective curative medicine is available, a healthy immune system is one of the most important weapons. Viral clearance and infection recovery require activation of the host's immune response and nutrition could be a means of achieving it. Optimal nutrition and dietary nutrient intake impact the immune system through gene expression, cell activation, and signaling molecules modification [1].

Nutritional status as a modifiable factor is a key element in the functioning and maintaining of the immune system. The immune system is dependent on adequate micro and macronutrients. Deficiency or insufficient nutrients as a result of inadequate intake and reduced absorption or inadequate bioavailability requires correction to properly maintain the immune system function. Without adequate nutrition, the immune system is clearly deprived of the components needed to generate an effective immune response. A functioning immune system is crucial in the fight against COVID-19. To fight back, the body needs sufficient vitamins, proteins, and other nutrients. The impact of micronutrients such as vitamins and minerals on the body's health is critical and deficiency in any of them can cause severe and even life-threatening conditions. Micronutrients that are involved in regulating and shaping an immune response are vitamin C, D, A, E, and zinc.

## **Vitamin C**

Vitamin C plays an important role: Synthesis of collagen in connective tissues acts as an antioxidant. Humans cannot synthesis (synthesize) vitamin C, and must obtain it through our

diet. Vitamin C supports immune functions and protects against infection caused by a coronavirus. It acts as a weak antihistamine agent to provide relief from flu-like symptoms such as sneezing, a runny or stuffy nose, and swollen sinuses. Vitamin C deficiency is associated with increased susceptibility to infections, a weak immune response, poor wound healing, and an increased risk of pneumonia. Vitamin C has previously been used for the treatment of severe sepsis and septic shock; it was proven to be very effective [2].

Ascorbic acid promotes the development and maturation of T-lymphocytes, in particular, NK (Natural Killer) cells involved in the immune response to viral agents. The inhibition of ROS production and modulation of the cytokine network is done typically of the systemic inflammatory syndrome. In COVID the cytokines activate the neutrophils which accumulate in the lungs, and by activating the cell-mediated immune response, it destroys the alveolar capillaries and the lung parenchyma, is known as ARDS. Vitamin C helps to eliminate fluid by preventing the activation and accumulation of neutrophils and reducing alveolar epithelial water channel damage. The human-controlled trials had reported that there was a significantly lower incidence of pneumonia in vitamin C supplemented groups, suggesting that vitamin C might prevent the susceptibility to lower respiratory tract infections under certain conditions.

COVID-19 had been reported to cause lower respiratory tract infections, so vitamin C could be one of the effective choices for the treatment of COVID-19. Although vitamin C generally exhibits low toxicity, taking >2 g of vitamin C per day may cause adverse gastrointestinal events including abdominal pain, diarrhea, and nausea. Although vitamin C is a water-soluble vitamin, with the excess excreted through urine, it can contribute to the formation of renal stones [3].

Healthcare professionals should take vitamin C to boost their immune system. Clinical studies are needed to develop standard protocols for bedside use.

## Vitamin D

The sunshine vitamin has many mechanisms by which it reduces the risk of microbial infections and death. The role of vitamin D in reducing the risk of the common cold COVID-19 infection is associated with the increased production of pro-inflammatory cytokines, C-reactive protein increased risk of pneumonia, sepsis, acute respiratory distress syndrome, and heart failure. Serum 25-hydroxyvitamin D concentrations tend to decrease with age which may be important for COVID-19 because of case-fatality rates (CFRs) increase with age. The reasons include less

time spent in the sun, leading to reduced production of vitamin D as a result of lower levels of 7-dehydrocholesterol in the skin [4].

Drugs include antiepileptics, anti-inflammatory agents, antihypertensives, antiretrovirals, endocrine drugs, and some herbal medicines, which can cause vitamin D deficiency [5]. Vitamin D deficiency is associated with increased risk of acute viral respiratory infection and community-acquired pneumonia, with several molecular mechanisms proposed to explain this association. Vitamin D supplementation also enhances the expression of genes related to antioxidation (glutathione reductase and glutamate-cysteine ligase modifier subunit).

Vitamin D supplementation has also been shown to reduce the risk of respiratory infection. Vitamin D prophylaxis (without over-dosing) may contribute to reducing the severity of illness caused by SARS-CoV-2, particularly in settings where hypovitaminosis D is frequent. This will include people with underlying gastroenterological conditions where vitamin D deficiency is more prevalent.

Since most of the Indian population is deficient in Vitamin-D daily exposure to sunlight can be greatly beneficial and treat the deficiency.

## **Vitamin A**

Vitamin A maintains the vision and promotes growth and development. It helps in protecting epithelium and mucus integrity in the body and also helps in the development of the immune system. Vitamin A has a regulatory role in cellular immune responses and humoral immune processes, to form epithelial and mucous tissue, it is the first line of defense against pathogenic invaders. Retinoic acid lowers inflammation by inhibiting the release of inflammatory factors of macrophages [6].

## **Vitamin E**

It is a fat-soluble antioxidant that can protect the polyunsaturated fatty acids (PUFAs) in the membrane from oxidation. Vitamin E regulates the production of reactive oxygen species (ROS), reactive nitrogen species (RNS), and modulate signal transduction. Vitamin E is a major fat-soluble antioxidant that scavenges peroxy radicals and terminates the oxidation of

polyunsaturated fatty acids (PUFAs). The antioxidant activity of vitamin E may be responsible for the regulation of several enzymes involved in signal transduction because the activity of signaling enzymes is regulated by the redox state.

Vitamin E may directly bind to the enzymes involved in the generation of lipid mediators or to the transport proteins involved in signal transduction [7]. Vitamin E may affect the membrane protein interaction and translocation of the enzymes to the plasma membrane and therefore change the activity of signal transduction enzymes. In humans, the effects of vitamin E on the natural incidence of infectious diseases have been determined by the immunostimulatory effects of vitamin E confer improved resistance to infection

## Zinc

The trace element zinc is a critical cofactor for many proteins involved in the cellular process like differentiation and proliferation. An average adult weighing 70kg has a body zinc content of 1.4~2.3 gm, the highest tissue concentration being in the prostate, seminal fluid, uveal tissue, and skin. RDA of zinc for an average adult male is 11mg and the requirement increases from 8 mg/d to up to 12mg/d in females during pregnancy and lactation.

Zinc deficiency is caused due to inadequate intake, poor gastrointestinal absorption, or augmented excretion of zinc caused by diseases and promotes disease progression. Zinc modulates antiviral and antibacterial immunity and regulates inflammatory response. Zinc deficiency is surprisingly common in modern-day lifestyle and results in dysfunction of both humoral and cell-mediated immunity and increases susceptibility to infectious disease. Through upregulation of interferon-alpha production, zinc increases its antiviral activity.

Zn<sup>2+</sup> possesses antiviral activity through inhibition of SARS-CoV RNA polymerase. It decreases the activity of angiotensin-converting enzyme 2(ACE2), known to be the receptor for SARS-Cov-2. Improved zinc status may also reduce the risk of bacterial co-infection by improving mucociliary clearance and barrier function of respiratory epithelium. Increased zinc concentrations inhibit RNA dependent, RNA polymerase, and other proteins essential for the incompleteness of different stages of virus life cycles [9].

Zinc may possess protective effect as preventive against COVID-19 through reducing inflammation, improvement of mucociliary clearance, prevention of ventilator-induced lung

injury, modulation of antiviral and antibacterial immunity. Consumption of up to 50mg zinc per day can provide a protective role against the COVID-19 pandemic by improving host resistance against viral infection.

## Conclusion

A well-functioning immune system is crucial to fight against COVID-19. To maintain it, the body needs sufficient vitamins and other nutrients. But that is exactly what many people lack. Taking care of our gut health and especially nurturing a highly diverse microbiota through a dietary intake rich in a wide range of plant sources, fruits, vegetables, grains, and nuts will favor a robust immune system and indirectly increase our ability to fight viral attacks in every organ including the lungs. For a viral disease like COVID-19, where no pharmacological strategies for prevention or treatment are presently available and where the exact time of the ending of the alarming situation is unknown, nutritional strategies for enhancing immunity is something to be explored. We are entering an era where we can increasingly modify health through food and measure the effects through our microbes or metabolites.

A diet containing the required macronutrients and micronutrients and adding prebiotics and probiotics to improve the gut health, and consuming green leafy vegetables and colored vegetable that contains phytonutrients and antioxidants, by choosing a color a day to our everyday diet along with physical exercise and exposure to sunlight can boost our immune system.

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**Volume 1 Issue 1 September 2020**

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