

Vitamins and Minerals in the fight against COVID-19: A Brief Review

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Abstract

COVID-19 is a severe acute respiratory syndrome (SARS)- CoV-2 caused by a novel coronavirus. Since its outbreak in November 2019, more than 1.8 million have succumbed to it. The vulnerable group includes the elderly and immunocompromised individuals. The severity of the disease depends mainly on the individual's immune response. Vitamins and minerals play a critical role in maintaining a strong immune system. This article reviews evidence-based research on the role of vitamins and minerals in building up immunity, focusing on the fight against COVID-19. Vitamin D, C, B12, folate and zinc were found to alleviate the severity and help rehabilitate COVID patients. Vitamins and minerals should be used as a supportive treatment to improve immunity and relieve the severity. This article also highlights the importance of nutrition education and awareness among the people on the toxic/ side effects of overconsumption of vitamins and minerals.

Keywords: COVID-19, Immunity, Vitamins, Minerals

INTRODUCTION

COVID-19 is an emerging respiratory disease caused by the novel coronavirus SARS-CoV-2. It is indeed becoming the most significant health challenge of the 21st century. There are currently more than 84 million confirmed cases, and more than 1.8 million have succumbed to death as per the World Health Organization (WHO) report.¹ Besides this, the secondary effect of the disease, like coping with the lifestyle change, living in constant fear, anxiety, paranoia and economic downfall has affected almost all the populace around the world.² We don't have effective natural immunity against SARS-CoV-2 as it is novel to the human immune system and thus can be one of the factors for its fast spread.³ Various scientific communities are working hard to combat the crisis and stabilize the situation. Still, the normalization of the living seems a little far away.

Several health agencies have provided guidelines for controlling the spread of the virus until an effective therapeutic solution is discovered. Among them, social distancing, wearing of mask and following hygienic practices are given prime importance.⁴ Social distancing has caused a restriction in people's movement and many

people are confined to their homes. This, in turn, has caused a significant impact in both the physiological and psychological state of the individual and can cause a long-term health effect in the near future, posing an additional healthcare burden.

Epidemiological studies have shown that people with the suppressed immune response like older people, populations with existing morbidities are more susceptible to mortality and severe symptoms.⁵ Since there is no approved and proven preventive and curative medicine for COVID-19, building up immunity can be a powerful weapon in relieving the severe symptoms and associated mortality.⁶ Measures to improve the individuals' immune system should be prioritized. In this regard, nutritional research aiming to improve the individual's immunity and well-being should be at the forefront. Also, lifestyle modification, balanced nutrition and integrative medicine may provide an effective solution in achieving holistic living. This will make people not only physically strong but also mentally prepared for current and future pandemics.

Therefore, this review provides an understanding of the role of nutritional and lifestyle

modification to give a glance at the holistic approach of living to face the stress related to pandemic.

COVID-19, Immunity and Nutrition

The relationship between healthy living and a balanced diet has been well established. The role of nutrients as a preventive measure for supporting the immune system for healthy living is well documented.⁷ Following a specific dietary pattern can help prepare the body for future stress like inflammation or flu. Micronutrients play an essential role in the body's immune response. A scientific panel of the European Food Safety Authority (EFSA) has recognized that vitamins and minerals can play a crucial role in the immune system's functioning based on scientific data collection. They reported that vitamins like D, A, C, specific B vitamins like folate, B6, B12, and minerals like zinc, iron, copper and Selenium play a significant role in preserving the immune system.⁸

Role of vitamins in immunity and COVID-19

Fat-soluble vitamins play a significant role in immune cell maturation and functioning. Children with deficiency are more prone to a wide range of infectious diseases. Studies have reported that countries that showed a suboptimal vitamin A status reported slightly higher COVID-19 incidence and mortality⁸—suggesting a slight correlation between the vitamin A intake and incidence of COVID. Significantly lower vitamin D level was reported in severe cases of COVID-19 in South Asian populations.

Lower vitamin D levels accompany increased inflammatory cytokines and thus considerably increase the risk of upper respiratory tract infections⁹. Supplementation of vitamin D might be useful in reducing the severity and mortality associated with COVID. However, it should be kept in mind that excess consumption of vitamin A and D can lead to toxicity. Thus, it should be consumed within the recommended level.

Vitamin C is a natural antioxidant and aids in reducing oxidative stress in the body. Vitamin C is being used for reducing the severity of common cold and flu for a very long time. A recent report has suggested that a small group of COVID-19

patients receiving intravenous vitamin C showed a better recovery and vitamin C supplementation showed an increase in the oxygenation index in COVID-19 infected patients¹⁰.

Oxygenation index is a measure of oxygen inspired and its utilization in the body, it is generally used in intensive care to assess the severity of hypoxic respiratory failure¹¹. Although vitamin C supplements have been found effective in shortening the duration and severity of the infectious disease, it is important to point out that it has no effect on reducing the risk of contracting the flu.

B group vitamins are also reported to be useful in suppressing the complications associated with the COVID-19. Studies have shown that folic acid can inhibit furin, a possible therapeutic target for COVID-19. Thus folate helps prevent the binding by the SARS-CoV-2 spike protein and, in turn, prevent cell entry and virus turnover¹². Therefore, suggesting the application of folate in the management of COVID-19-associated respiratory disease during the early stages. A small group study has shown that B12 supplements can aid in reducing organ damage related symptoms of COVID-19¹³.

Vitamin B12 deficiency is mostly reported in the geriatric population due to malabsorption as they lack intrinsic factor required for the absorption of B12¹⁴. Thus, ensuring the dietary adequacy of vitamin B12 in elderly people, a vulnerable group for COVID-19 infection, can help improve immunity and reduce the severity. A clinical study has suggested that COVID-19 patients receiving vitamin B12, vitamin D, and magnesium supplements showed reduced symptom severity and intensive care support¹⁵. This study indicates the importance of optimum nutrients in the diet can act as an adjunct preventive measure, but it should be highlighted that supplementation with micronutrients is not a curative approach.

Role of minerals in immunity and COVID-19

Zinc (Zn) plays an essential role in maintaining immune health. Zn deficient individuals show compromised immune response and increased susceptibility to infectious diseases¹⁶. The critical

role of Zn in antiviral immunity is well documented. An *in-vitro* study has pointed out that Zn can inhibit the replication of SARS-CoV-1 by blocking the polymerase activity; thus, pointing out the preventive role of the Zn in infectious diseases¹⁷.

A small group study involving the treatment of four COVID-19 cases with a high dose of zinc salts showed the reduction of disease symptoms within 24 h after the initiation of high dose zinc salt tablets¹⁸. Due to the study's small sample size, it is a little ambiguous to make a definitive statement about Zn usage as a treatment remedy. However, it gives an idea that Zn may be used as a supportive treatment.

Iron is known to participate in several immune processes and is an essential component for enzymes involved in immune cells' crucial activities. SARS-CoV-2 patients have shown disrupted Fe homeostasis¹⁹. Maintaining an optimum Fe level may play a critical role in managing the disease and reducing its pathogenesis²⁰. Studies have reported a higher severity of the symptoms and a longer stay in hospital of anemic patient^{21, 22}. However, the major concern among the COVID-19 patients is hyperferritinemia²³.

Hyperferritinemia is a condition in which the body has an excess of ferritin, a cellular iron storage protein, due to its ability to bind to Fe. Inflammation generally disrupts the Fe homeostasis as reflected by high Fe content of the reticuloendothelial cell and high serum ferritin whereas low circulating Fe¹⁹. Ferritin is generally known to have pro-inflammatory properties, thus can increase the severity and prognosis for infectious diseases^{19, 23}. Some studies have also suggested that the low level of iron can help mitigate the infectious nature of the disease since COVID-19 is an RNA viruses-born disease highly dependent on iron for prognosis²⁴. These results suggest that using Fe as therapy for COVID-19 can be decisive and requires further understanding and evidence. Moreover, a high level of Fe can also cause oxidative stress²⁵; thus, a recommendation for optimum Fe intake should be provided for positive clinical outcomes for the management of virus borne infectious disease.

Copper and selenium are also relevant in maintaining the optimum immune system. Copper is known to be a potent antiviral, and thus it has the potential to be used in the therapeutic regime for COVID-19. Selenium is also a potent antioxidant and can help COVID-19 patients recover from oxidative stress faster. Clinical trials have shown that the populace with the Selenium deficiency is likely to exhibit higher mortality and severity²⁶. Thus, having an optimum copper and selenium level can help build up immunity. However, the excess of minerals can also cause toxicity, so care should be consumed within the recommended level. It should also be emphasized that minerals are not to be used as curative therapy but as an adjunct therapy.

Role of fatty acids and herbal extracts in immunity and COVID-19

Essential fatty acids are also known to promote immunity and preventive action against inflammation. Omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), provide anti-inflammatory benefits to the intensive care patients²⁷. However, recent findings have suggested that the EPA and DHA are prone to non-enzymatic oxidation, resulting in the formation of potentially toxic oxidation products, thereby increasing the cell membrane's oxidative stress²⁸.

Thus, care needs to be taken while recommending the essential fatty acids to COVID-19 patients. Herbal extracts and nutraceuticals also play a significant role in building up immunity and provide relief to the inflammation and thus possess great application as preventive medicine²⁹. However, there is a need to do further investigation of the herbal extract to find concrete evidence as a curative measure

Need For nutrition awareness and education for COVID-19 and future pandemics.

Optimum nutritional status is the crucial factor in alleviating the adverse health effects associated with the COVID-19 pandemic. The nutritional recommendation can be an effective way to provide people with a guide to maintain optimum

nutritional status. Dietary recommendations and guidelines are an effective way of fastening the recovery rate in infected COVID-19 patients. Pandemic associated social distancing and isolation has resulted in restricted movement, stress and anxiety among the general population which has caused serious health effects especially among elderly population³⁰. The effect of emotions on eating behavior is very well studied. Macht M³¹, in his explicating five-way model of emotions and diet, have reported that the food intake changes are a natural response to stress and heightened emotional states.

A small group study in Italy have reported the shift towards more carbohydrate-rich and junk food like pasta, bread, and confectionery during lockdown³². In Mumbai, India, increased consumption of snacks and reduced fruits and vegetables was documented³³. This can play a significant role in promoting obesity and other non-communicable diseases and have long-term health consequences. Supporting this, many studies in China, USA, and Italy have reported significant weight gain during the early stages of COVID-19³⁴.

Since the outbreak of pandemic social media is also flooded with false information regarding a single food, nutrient or herbs' promising curative, and preventive effect³⁵. These unsupported claims may negatively implicate an individual's health because overconsumption of one food or nutrient may result in toxicity. It should be emphasized that supplementation with vitamins and minerals does not treat or prevent COVID-19 infection. Still, it can only optimize the immune

response, acting just as an adjunct treatment. In this regard, making people aware of the nutritional needs and the tolerable upper limit for supplementation can pose a great advantage. Therefore, there is a need for nutritional guidelines and recommendations to optimize nutritional status and immune response and better preparedness for the next pandemic.

Conclusion

An optimum intake of nutrients can help in building up immunity. However, the nutrient supplementation should be used as an adjunct approach for treating and preventing infectious diseases. Nutrition researchers and educators have a greater responsibility to inform the people, particularly the vulnerable group, about the potential benefits of optimum nutrition and healthy eating habits to prepare their bodies for the current and future infectious pandemic. In this regard, coming up with an evidence-based nutrition recommendation can come in handy. Also, change in the lifestyle is much needed to reduce mental and emotional stress due to pandemic. Engaging in physical activities like yoga, meditation, exercising can relieve stress. Thus, the inclusion of these guidelines can help an individual to cope up with pandemic-related stress.

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