

The Potential Effects and Role of Vitamin C on COVID-19 Infection and Progression: A Review

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ABSTRACT

Background: In the present scenario, COVID-19 has become a global pandemic, creating a life threat for humans. Some studies depicted that the use of vitamin C may minimize this infection. On the contrary, few studies have denied any beneficial role of vitamin C in COVID-19. The controversies still prevail that need to attain a consensus. Therefore, through this review, we tried to find out the effects of vitamin C on COVID-19 infection.

Objective: The objective of this study is to find the impact of vitamin C supplementation on COVID-19 infection and its severity.

Conclusion: Vitamin C supplementation can strongly help in reducing COVID-19 and many other infectious diseases by boosting the immune system. Therefore, a regular administration of vitamin C is required to develop strong immunity against the COVID-19 pandemic.

Keywords: Biochemistry, COVID, COVID-19, Healthcare workers, Seroprevalence, Severe acute respiratory syndrome 2, Total antibodies, Vitamin D.

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INTRODUCTION

Vitamin C, also known as ascorbic acid or ascorbate, is a strong water-soluble antioxidant. It succors by directly scavenging oxygen free radicals and acts as an important cofactor for the production of catecholamines, cortisol, and vasopressin in humans.¹ Also, in leukocytes, it is found in elevated concentrations and involved in several functions and immune responses.² Arising evidence in preclinical examinations showed that ascorbic acid plays a critical part in improving the impacts of inflammation by repressing proinflammatory production of cytokine, helping immunoregulation, killing reactive oxygen species (ROS), and safeguarding host cells.^{3,4} It includes a wide range of actions like phagocytosis, microbial clearance, neutrophil chemotaxis, antiviral, immunomodulatory, and anti-inflammatory impacts^{5,6} and ameliorates T-cell proliferation.⁷ It also functions as a cofactor for the enzyme peptidylglycine α -amidating monooxygenase, which is required for the synthesis of endogenous antidiuretic hormone.⁸ When given prior to surgery, vitamin C reduces the adrenal suppression caused by etomidate.⁹ It has been extensively utilized for critically ill patient management.¹⁰

COVID-19 has become the globally spreading contagious disease caused by severe acute respiratory syndrome 2 (SARS-CoV-2). It was first discovered in Wuhan, China.¹¹ On March 11, 2020, COVID-19 was announced as a global pandemic by World Health Organization (WHO).¹² This virus affects people of every age group. Elderly people with comorbidities are becoming increasingly ill and even dying. COVID-19 is characterized by cough, fever, sore throat, and shortness of breath. Its symptoms can be seen between 2 and 14 days.^{13,14} All inclusive by WHO, as of August 23, 2022, there have been 594,367,247 affirmed cases of COVID-19, including 6,451,016 passings. As of August 16, 2022, a total of 12,409,086,286 vaccine doses have been managed.¹⁵ Some studies depicted that vitamin C supplementation may minimize this infection as its deficient individuals are covetous to severe respiratory infections.^{6,16}

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Therefore, through this review, we can determine whether taking vitamin C supplements lowers COVID-19 risk factors.

MATERIALS AND METHODS

An extensive search of the literature for studies on vitamin D levels and COVID-19 was performed. All observational studies reporting vitamin C levels were searched using a different combination of MeSH terms related to COVID-19 and vitamin C through PubMed, Scopus, DOAJ, and Google Scholar.

ANTIVIRAL ACTION OF VITAMIN C

Vitamin C supplementation has been shown to have a wide range of antiviral effects against certain viral infections.¹⁷ Various viral infections such as sepsis, sepsis-related acute respiratory disease syndrome (ARDS), and other common ailments have been linked to lower vitamin C levels.¹⁸ As vitamin C inhibits viral growth when present in sufficient quantities *in vitro*, the elevated levels may have virucidal effects.¹⁹ In a study conducted by Li et al., it was shown that influenza-infected mice were unable to produce vitamin C, and then the mice which didn't receive vitamin C supplements had higher lung pathology scores.²⁰ In influenza-induced pneumonia,

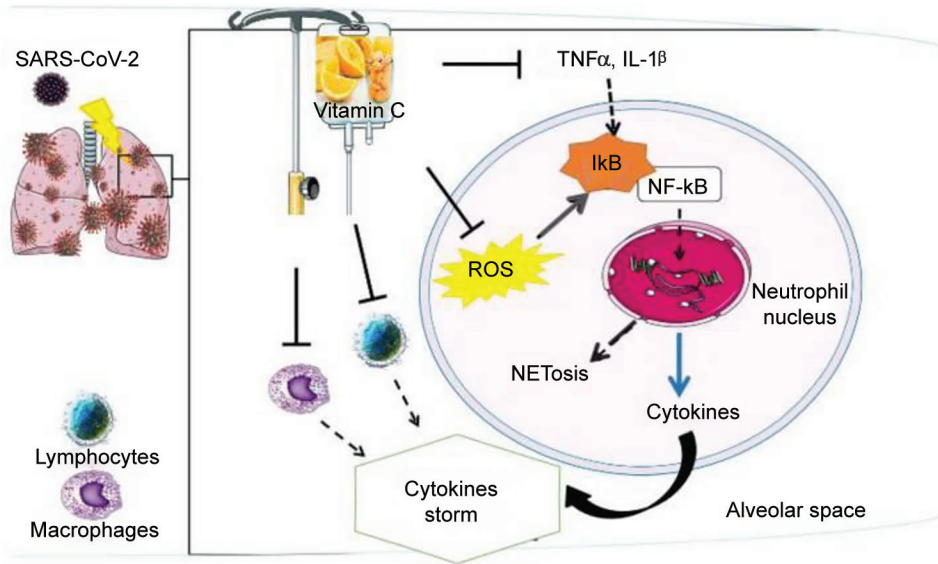


Fig. 1: An IA administration of vitamin C to improve the specific actions of immune system²⁹

severe infections can be reduced with the assistance of vitamin C supplementation (300 mg/day).¹⁷ Another study of 133 patients illustrated that taking vitamin C helps in preventing Herpes simplex keratitis (odds ratio: 0.25).²¹ Human brains also contain a lot of vitamin C, which is thought to play a crucial role in neuro-transmission, neuro-protection, and regulation.²²

Vitamin C has recently been shown to be a potential anti-coronavirus agent in some studies.^{13,23} Therefore, it is hypothesized that taking vitamin C may lessen the severity of COVID-19.

THE ROLE OF VITAMIN C IN THE IMMUNE SYSTEM

The immune system functions as a defense mechanism in the body against various bacterial and viral actions. It mainly consists of innate and adaptive responses.¹⁶ Vitamin C is an important nutrient for various immune functions and influences many pathways of immunity-killing microbes by phagocytosis, controlling the growth of innate and adaptive immunity cells, promoting epithelial barrier activity, and developing antibodies.^{6,16} The neutrophils extracellular trap (NETosis) synthesis pathway and uncontrollable inflammatory cytokine production in the alveolar region may be blocked by an intermittent auscultation (IA) of vitamin C, which may affect specific neutrophil capacities (ROS and tumor necrosis factor (TNF), interleukin-1, (IL-1 intervened) (Fig. 1). In an experiment, it was illustrated that cellular and humoral immune responses may be diminished by a low vitamin C concentration.²⁴ Human and *in vivo* model experiments also demonstrated its effects on various populations of defense cells.^{25,26} A meta-analysis demonstrated that intravenous vitamin C treatment for ARDS and sepsis resulted in reduced vasopressor requirements and a shorter intensive care unit (ICU) stay.²⁷ In healthy individuals, clinical investigations have proved that taking vitamin C supplements increases lymphocyte multiplication and natural killer cell chemotaxis.^{28,29} Such immunological alterations indicate that vitamin C has a significant impact on the immune system. Hence, we can use it against COVID-19 complications.

ACTION OF VITAMIN C AGAINST INFECTIONS INCLUDING COVID-19

The dysfunctional immune system's oxidative stress and excessive free radicals, intended to kill the virus but causing permanent injury to (normal) lung tissue, are primarily to blame for COVID-19's severe lung injury. Vitamin C can reduce oxidative damage and thus neutralize the free radicals in the lungs. In case of the imbalance between antioxidants and oxidants, damage in body organs is seen which progresses the patient to severe disease.³⁰ The antioxidant status can be improved by sufficient supplementation of vitamin C.

Several studies have shown the reduced concentration of vitamin C in severely affected patients.²⁷ According to a current research study comprising 17 individuals found that lowering inflammatory marker levels with intravenous vitamin C helps in treating acute COVID-19 illness. According to the trials performed in China (Wuhan), it was significantly demonstrated that individuals suffering from corona showed improvement when a higher dose of vitamin C (24 gm/day for 7 days) was supplied.³¹ According to these findings, COVID-19 positive patients have very low concentrations of vitamin C levels. Therefore, it can be depicted that vitamin C is safe to use as a supplement against COVID-19.

CONCLUSION

We conclude that vitamin C plays a vital role in protecting and curing various infections. This may strongly help in reducing COVID-19 infection by boosting the immune system. Vitamin C is generally utilized in the treatment of different sicknesses. It acts as a strong antioxidant and positively functions in scavenging oxidative species, modulating signaling pathways, regenerating vitamin E, activating proinflammatory transcription factors, gene regulation, phagocytosis, boosting T-cell signaling pathways, and neutrophil motility to the infection site. As a result, in order to strengthen immunity against the COVID-19 pandemic, vitamin C supplementation is necessary on a consistent basis.

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