



**CORRELATION OF VITAMIN C WITH DISEASE  
SEVERITY IN PATIENTS**

**Dr Manoj Kumar Sharma<sup>1</sup>**

Former Head, Department of Botany

Nirmal P G college, Hindaun city, District -Karauli, Rajasthan,

India, Pin code 322230

**Dr Praveen Goyal<sup>2</sup>**

MBBS, Dipcard, Junior resident (academic)

R K D F medical College Bhopal

**NALLU ANVESH REDDY<sup>3</sup>**

1st year PG resident, Dept of surgery

MPGIMER, NASIK

**4. Dr Rajat Garg<sup>4</sup>**

Consultant, Avram Corporation

248/6 Shastri Nagar Meerut, UP

**DANDARE TUSHAR KHAMESHWAR<sup>5</sup>**

1st year PG resident, Dept of surgery

MPGIMER, NASHIK

**MOHAMMED SHAHBAZ<sup>6</sup>**

1st year PG resident, Dept of surgery

MPGIMER, NASHIK

**Abstract**

Vitamin C is necessary for connective tissue formation and preservation. Vitamin C helps to prevent infections by boosting the immune system and reducing the severity of allergic reactions. The significance of vitamin C and its health advantages in relation to human diseases like atherosclerosis, cancer, mental toxicity, diabetes, and dementia is still up for debate. The primary cause of multiple organ failure and acute respiratory distress syndrome is the inflammatory response in people with Coronavirus disease 2019, especially in those with severe and critical illness. Numerous studies have shown that taking a lot of vitamin C reduced the inflammatory responses that are linked to sepsis and acute respiratory distress syndrome. The objectives of this study were to determine the safety and efficacy of high-dose vitamin C in the 2019 Coronavirus disease. In this review, 76 individuals with Covid illness in 2019 were isolated into two gatherings: a high-portion L-ascorbic acid gathering with 46 individuals, and a standard treatment bunch with 30 individuals.

**Keywords:** *Vitamin C, immune system, allergic reactions, inflammatory responses, Coronavirus disease, L-ascorbic acid, toxicity.*

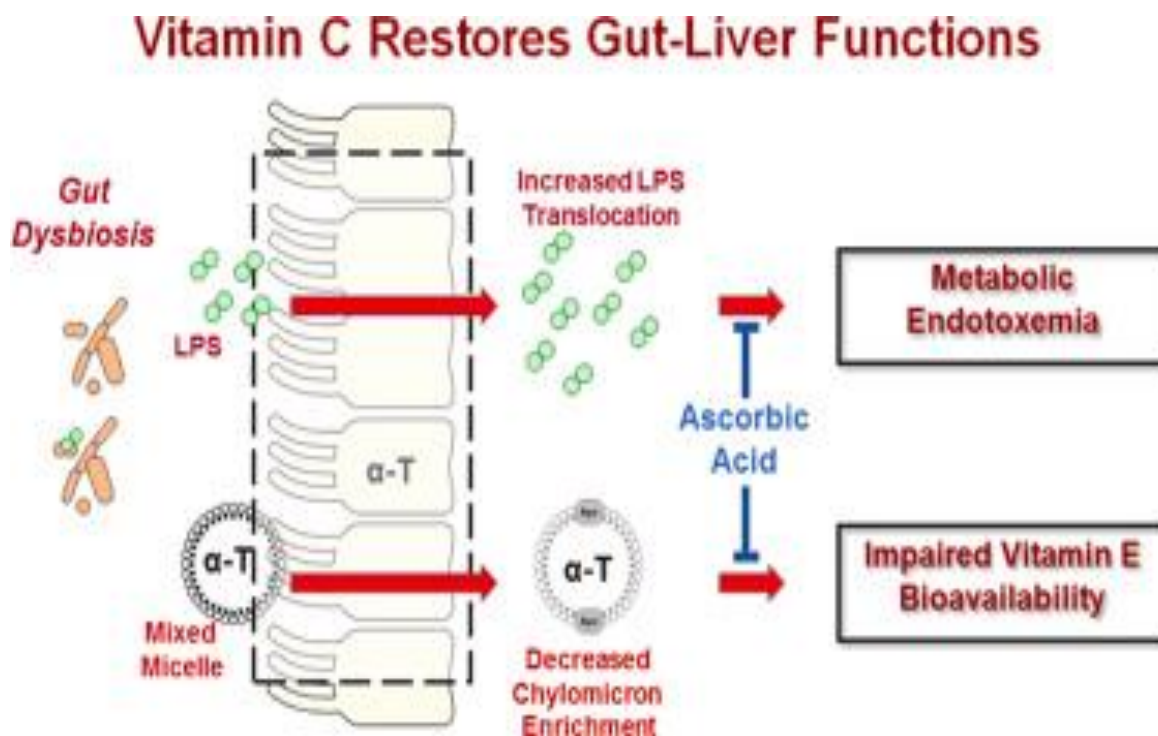
## **Introduction**

Vitamin C is generally called ascorbic acid, is a basic enhancement that expects a crucial part in staying aware of overall prosperity and flourishing. It is famous for its cancer avoidance specialist properties and its significant impact on the protected structure. All through the long haul, researchers have explored the correlation between vitamin C levels and sickness reality, particularly according to various infections. Different assessments have researched the probable impact of vitamin C in freeing the earnestness from different sicknesses. One of the essential areas of focus has been respiratory infections, including common colds, influenza, and, shockingly, serious respiratory illnesses like pneumonia. Vitamin C is accepted to enhance immune function by supporting the production and activity of a couple of insusceptible cells, in this way perhaps reducing the reality and term of respiratory infections. Additionally, the connection of vitamin C has been examined in the context of chronic sicknesses such as cardiovascular illnesses, cancer, and diabetes. Recently many investigators also revealed the relation of Vitamin C in combating the pandemic covid-19 that caused widespread calamity. Therefore within this investigation, the correlation of disease severity with that of Vitamin C was investigated particularly in relation to Covid-19 which will help to gain a deep insight regarding the potential mechanisms that will aid in effective treatment options.

## Review of the literature

According to Patterson *et al.* 2021, The lipid bilayer of the plasma membrane prevents direct entry of vitamin C into cells because of its high water solubility. With intracellular vitamin C concentrations of 1-2 mM, neutrophils often carry 10-100 times as much vitamin C in their cells than is typically observed in plasma. Until neutrophils are stimulated and start to undertake an oxidative burst, levels of this intracellular concentration do not rise; instead, they reach 10–20 mM. This phenomenon and the antioxidant qualities of vitamin C have led to the theory that it is necessary for neutrophil activity and, consequently, for a healthy immunological response. There are indications that providing enough vitamin C to people with low levels can permit adequate immunological activity, limiting and reducing the severity of the sickness. A specific transport system, sodium-dependent vitamin C transporters (SVCT), which is found in the plasma membrane, mediates the entrance process. There are two types of SVCT such as SVCT1 and SVCT2. Different cells and tissues express vitamin C transporters in different ways. SVCT1 is present in many distinct organs and cell types, including the liver, kidneys, and intestinal epithelial cells, in contrast to SVCT2, which is expressed in a variety of tissues including the liver, brain, heart, chondrocytes, and osteoblast. Oxidative stress, aging, and inflammatory factors all have an impact on how SVCT 1 and 2 are expressed. The transcript level of the SVCT2 transporters is significantly downregulated in osteoarthritic tissue in comparison to healthy tissue. On the other hand, not every clinical circumstance has an effect on the creation of this vitamin C transporter. Numerous in vitro and animal studies have shown how the synthesis of the vitamin C transporters (SVCT1 and SVCT2) is significantly altered by oxidative stress, inflammation, and other disease states. Genetic variation and SVCT transport dysregulation may have a major impact on a variety

of age-related pathophysiological problems, increasing COVID-19 infection and intensity in some populations.



**Figure 1: Role of Vitamin C in restoring Gut-liver functions**

(Source: Traber *et al.* 2021)

According to Kwak *et al.* 2022, Oxidative stress manifests during an infectious state, particularly during lung infections or a critically unwell state after the infection. Vitamin C is a mineral with antioxidant capabilities that rise in diseased people, and infection frequently lowers vitamin C levels. Its anti-inflammatory and immunoregulatory characteristics can also help patients with asthma or other illnesses. Vitamin C helps shorten the duration and lessen the severity of a respiratory illness.

In particular, high-dose intravenous vitamin C (HDIVC) may lessen the severity of patients' symptoms, reduce the length of hospital stays and the time patients need ventilator support, result in vascular sparing, and reduce the in-hospital mortality rate. Particularly vitamin C has been recommended for use in patients with serious illnesses or respiratory tract infections due to its therapeutic benefits. People can take vitamin C orally or intravenously (IV). However, due to its slow rate of absorption, oral vitamin C consumption is restricted.

The bulk of vitamin C consumed orally leaves the body as it is being used, and because its peak plasma level is so low, it is difficult to reach the ideal plasma level. Contrarily, IV vitamin C therapy can quickly reach the therapeutic dose with 30-70 times greater peak plasma levels than those of oral vitamin C because it gets over the constraints of intestinal transporters (Traber *et al.* 2019). Patients with COVID-19 received HDIVC in multiple earlier studies that evaluated the significance of HDIVC in COVID-19 patients in various settings based on different clinical findings and outcomes. HDIVC did not reduce in-hospital mortality or the number of days in a 28-day period without invasive mechanical breathing. This finding suggests that HDIVC might benefit patients with severe COVID-19 by improving their oxygenation, even if HDIVC was successful in increasing the O<sub>2</sub>/fraction of supplied O<sub>2</sub> ratio in the arteries.

## Materials and Methodology

The study is a prospective cohort analysis of COVID-19 participants who are hospitalized. According to Diagnosis and Treatment of Pneumonia Infected by Novel Coronavirus, published by the National Health Commission of China, patients with COVID-19 are diagnosed. Patients who were under 18, sensitive to vitamin C, died within 24 hours of admission, were nursing or pregnant, or were under the age of 18 were not included in the study. You can divide the population

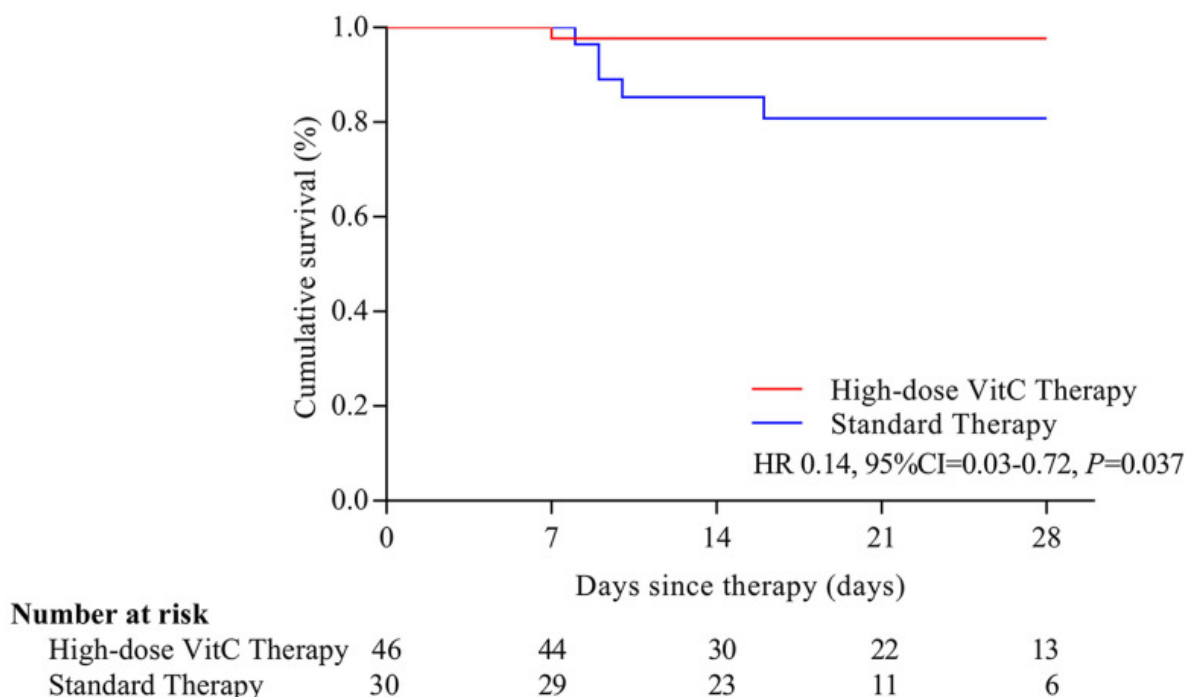
into two groups: those who receive regular therapy and those who receive large doses of vitamin C. The patient can be informed of the justification for the chosen course of action and any potential negative effects. The patient's consent is required before any operations are carried out. In addition to receiving standard care, patients in the high-dose vitamin C therapy group underwent a 5-day course that included a loading dosage of 6g added to 5% glucose solution for an intravenous high-dose vitamin C injection lasting over 60 minutes per 12 hours on the first day and 6g added to 5 percentage glucose solution for an intravenous high-dose vitamin C infusion that lasts over 60 minutes per day for the following 4 days. The standard therapy group includes patients who were only getting standard therapy.

## **Results and Discussion**

### **The Exclusion of Participants**

A total of 84 patients accepted high-dose vitamin C or standard therapy where overall 8 patients can be excluded because of their pregnancy (n=2), or lactation (n=1). And 1 patient of (n=3) where 1 patient died within 24 hr (n=1).

### **Baseline characteristics**



**Figure 2: Overall survival with the two treatments in COVID-19 patients. The risk of mortality was significantly reduced with high-dose vitamin C than with standard therapy**

(Source: Gao *et al.* 2021)

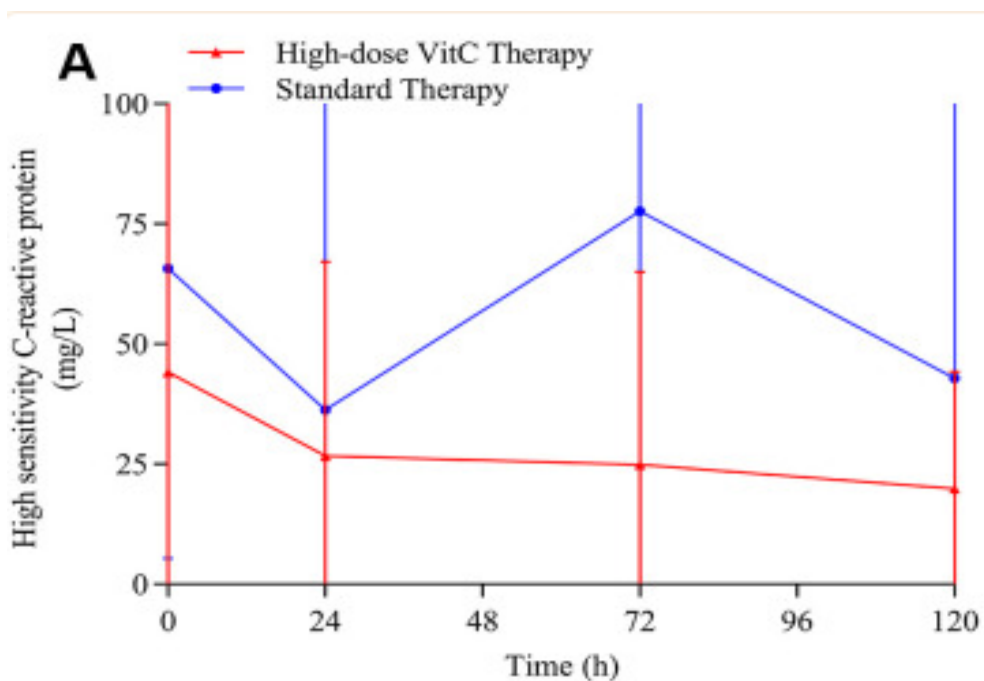
Among 76 patients with the baseline characteristics, 46 patients are advised to intake high-dose vitamin C whereas 30 patients are used as standard therapy. A total of 48 patients has diagnosed with medium COVID-19, & 28 patients are marked as the had severe disease.

### **Changes in biomarkers of inflammation after high-dose vitamin C therapy and standard therapy**

As compared with standard therapy, high-dose vitamin C reduced serum hs-CRP, procalcitonin (PCT), and interleukin-8 (IL-8) levels. The serum interleukin-2 receptor (IL-2R), interleukin-6

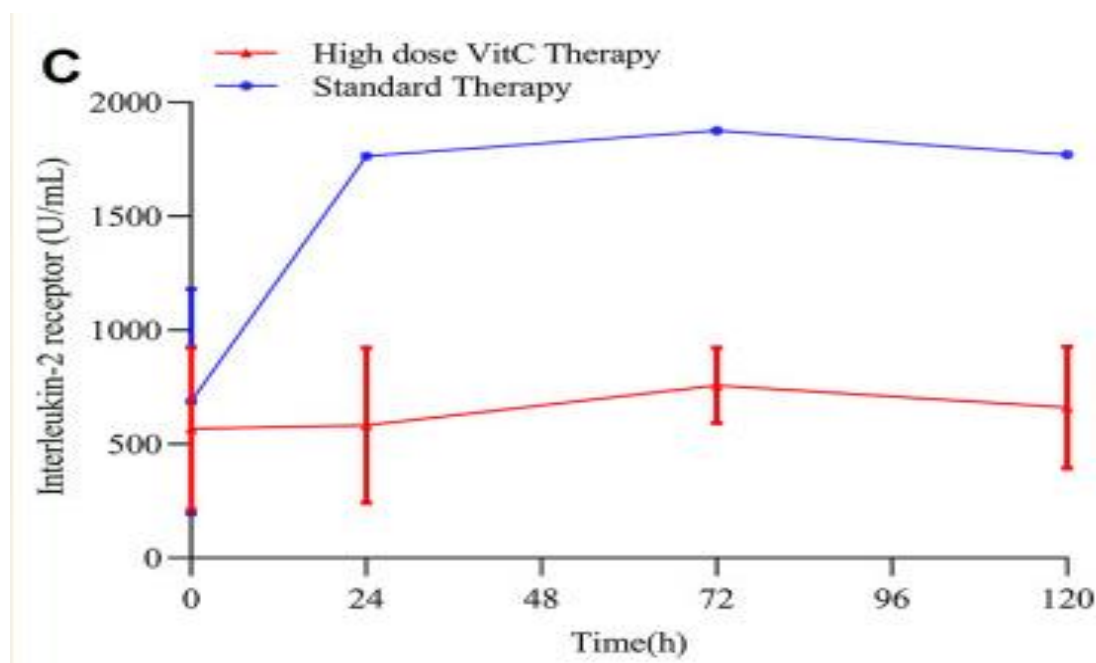


(IL-6), and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) levels were not affected remarkably in the high-dose vitamin C group.



**Figure 3: High-dose vitamin C reduced serum hs-CRP levels in COVID-19 patients**

(Source: Gao *et al.* 2021)



**Figure 4: High-dose vitamin C did not affect the serum IL-2R levels in COVID-19 patients**

(Source: Gao *et al.* 2021)

High vitamin C doses significantly reduced the serum levels of hs-CRP and PCT in COVID-19 patients. The degree of systemic infection in the body is correlated with the acute-phase inflammatory proteins CRP and PCT. High levels of CRP and PCT are related to organ failure and greater death rates among patients admitted to hospitals. People with COVID-19 who had lower CRP levels died less frequently than people with chronically high CRP levels, according to research (Gao *et al.* 2021). According to Jensen and colleagues, high PCT levels have also been connected to early, independent death prediction for patients who have been sent to intensive care units. According to recent research, PCT and hs-CRP levels were higher in COVID-19 patients. Vitamin C can directly reduce the production of reactive oxygen species in addition to maintaining endothelial barrier integrity, vasodilation, and downregulating the expression of inflammatory modulators. High-dose vitamin C therapy also reduced serum IL-8 levels in COVID-19 patients

when compared to standard therapy. The inflammatory cascade is controlled by the synergistic interaction of TNF-, IL-1, IL-6, and IL-8.

### **Conclusion and future scope**

High-dose vitamin C may diminish inflammatory reactions, improve oxygen support status, and reduce mortality in COVID-19 patients without having any harmful side effects. Additionally, it may be advantageous for older individuals and other populations with severe and critical illnesses. Vitamin C in high dosages may be effective in treating COVID-19. The results of numerous studies have demonstrated how a wide range of factors may influence vitamin C levels and the prevalence of insufficiency.

Vitamin C concentrations are a potential indicator of a balanced diet, but unfortunately, correct assessment is expensive, technically difficult, and time-consuming. To evaluate plasma concentrations, low-cost, precise, and commercially available procedures are necessary. The current evaluation of intake is also constrained and ignores the possibility that some significant crops, like cassava, could virtually entirely remove the vitamin before consumption. This data should be included in future nutritional reference tables. Numerous studies have examined the possibility that taking extra vitamin C could help prevent a variety of non-communicable illnesses and infections.

## Recommendations

A few evaluations have looked into the relationship between vitamin C levels and patients' actual illness states. Despite the fact that the results are not conclusive, several of the finds have an expected relationship. According to a study, getting enough L-ascorbic acid may help to lessen the severity of a few diseases (Carr *et al.* 2020). It has been determined that vitamin C plays a significant role in promoting collagen association, maintaining safe function, and serving as an expert in cancer prevention. These activities might enhance people's general prosperity and resiliency. A reduced bet of sickness and a more modest scope of secondary effects in certain diseases, such as respiratory infections like the common cold and pneumonia, have been connected to higher vitamin C levels. Regardless, it is fundamental for recollect that the evidence is contradictory, and it is anticipated that additional research will spread out a distinct causal connection. Regardless of the fact that it is overall protected to take vitamin C enhancements or eat an in any event, eating schedule, counseling a doctor preceding carrying out significant upgrades to a singular's vitamin C admission is great. Individual medical histories are stashed away, and a number of variables may affect how seriously vitamin C combats infection.

## Reference list

### Journals

Patterson, T., Isales, C.M. and Fulzele, S., 2021. Low level of Vitamin C and dysregulation of Vitamin C transporter might be involved in the severity of COVID-19 Infection. *Aging and disease*, 12(1), p.14.

Kwak, S.G., Choo, Y.J. and Chang, M.C., 2022. The effectiveness of high-dose intravenous vitamin C for patients with coronavirus disease 2019: A systematic review and meta-analysis. *Complementary Therapies in Medicine*, 64, p.102797.

Gao, D., Xu, M., Wang, G., Lv, J., Ma, X., Guo, Y., Zhang, D., Yang, H., Jiang, W., Deng, F. and Xia, G., 2021. The efficiency and safety of high-dose vitamin C in patients with COVID-19: A retrospective cohort study. *Aging (Albany NY)*, 13(5), p.7020.

Carr, A.C., Spencer, E., Dixon, L. and Chambers, S.T., 2020. Patients with community acquired pneumonia exhibit depleted vitamin C status and elevated oxidative stress. *Nutrients*, 12(5), p.1318.

Samadizadeh, S., Masoudi, M., Rastegar, M., Salimi, V., Shahbaz, M.B. and Tahamtan, A., 2021. COVID-19: Why does disease severity vary among individuals?. *Respiratory Medicine*, 180, p.106356.

Tada, A. and Miura, H., 2019. The relationship between vitamin C and periodontal diseases: a systematic review. *International journal of environmental research and public health*, 16(14), p.2472.

Traber, M.G., Buettner, G.R. and Bruno, R.S., 2019. The relationship between vitamin C status, the gut-liver axis, and metabolic syndrome. *Redox biology*, 21, p.101091.

JamaliMoghadamSiahkali, S., Zarezade, B., Koolaji, S., SeyedAlinaghi, S., Zendehtdel, A., Tabarestani, M., Sekhavati Moghadam, E., Abbasian, L., Dehghan Manshadi, S.A., Salehi, M. and Hasannezhad, M., 2021. Safety and effectiveness of high-dose vitamin C in patients with COVID-19: a randomized open-label clinical trial. *European journal of medical research*, 26(1), pp.1-9.

Hoang, B.X., Shaw, G., Fang, W. and Han, B., 2020. Possible application of high-dose vitamin C in the prevention and therapy of coronavirus infection. *Journal of global antimicrobial resistance*, 23, pp.256-262.

Zhang, J., Rao, X., Li, Y., Zhu, Y., Liu, F., Guo, G., Luo, G., Meng, Z., De Backer, D., Xiang, H. and Peng, Z., 2021. Pilot trial of high-dose vitamin C in critically ill COVID-19 patients. *Annals of intensive care*, 11, pp.1-12.