IJBPAS, March, 2023, 12(3): 1193-1202

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

THE SIGNIFICANCE OF VITAMINS IN COVID-19

RANA K[1*], KHARE S[1*], SADHU P[1], PATEL H[1] AND VAGHASIYA J[2]

1: Department of Pharmacy, Sumandeep Vidyapeeth Deemed to be University, Vadodara-391760, Gujarat, India

2: Parul Institute of Pharmacy, Parul University, Vadodara-391760, Gujarat, India

***Corresponding Author: Dr. Sarvajeet Khare & Dr. Kajal Rana: E Mail: sarvajeetkhare@gmail.com; ranakajal2107@gmail.com**

Received 11th April 2022; Revised 15th May 2022; Accepted 3rd Aug. 2022; Available online 1st March 2023

https://doi.org/10.31032/IJBPAS/2023/12.3.6950

ABSTRACT

Vitamins are natural materials found in minute quantities in herbal foodstuffs. Having too little of any particular vitamin may increase the risk of developing certain health issues. A vitamin is an organic compound, which means that it contains carbon. It is essential for all the body to get from food. Having too little of any specific diet plan also can moreover develop the threat of developing health issues. Vitamins A, D, E, and K are fat-soluble. Vitamin C and all B vitamins are water-soluble. Few of these are very effective in the treatment of covid-19. So, by adding these vitamins to the treatment of covid-19, we can reduce the symptoms of covid-19. In this study, we found that vitamin B12, A, C, D and E were highly effective; vitamin K, B6 and B9 were moderately effective; and vitamin B1, B2, B3, B5 and B7 were less effective in severe covid-19 conditions.

Keywords: Covid-19, Covid-19 patients, Vitamin, Vitamin deficiency

INTRODUCTION

Vitamins are natural materials found in minute quantities in herbal foodstuffs. Having too little of any particular vitamin may increase the risk of developing certain health issues. A vitamin is an organic compound, which means that it contains carbon. It is essential for all the body to get from food. Having too little of any specific diet plan also can moreover develop the threat of developing health issues **[1]**.

There are currently 13 recognized vitamins. Few of them are "Fat-soluble" and others

are "water-soluble" vitamins. Vitamins are either soluble or dissolvable, in fat or water.

Fat-soluble vitamins:

Vitamins A, D, E, and K are fat-soluble. The body stores fat-soluble vitamins from reliable sources in adipose tissue and the liver, and these vitamin reserves can remain in the body for days, sometimes months. Dietary fats help the body to absorb fat-soluble vitamins through the intestinal tract **[1]**.

Water-soluble vitamins:

Water-soluble vitamins do not stay in the body for a long time and cannot be stored. They leave the body through urine. For this reason, people need a more regular supply of water-soluble vitamins than fat-soluble vitamins. Vitamin C and all B vitamins are water-soluble **[1]**.

Table 1: The 13 Vitamins and their detailed information

Vitamins	Chemical name	Deficiency	Function
A	Retinol, Retinal, Beta-carotene	night blindness and keratomalacia, which causes the clear presheaf of the eye to dry and cloud.	Eye health
B1	Thiamine	Beriberi and Wernicke-Korsakov syndrome	Production of various enzymes that help to break down blood sugar levels
B2	Riboflavin	Pain in the lips and cracks in the mouth	Growth and development of somatic cells and helps the metabolism of food
B3	Niacin, Niacinamide	A health issue called pellagra, which causes diarrhoea, skin changes, and intestinal upset	Cells to grow and work correctly
B5	Pantothenic acid	Symptoms include paraesthesia, or "pins and needles"	Production of energy and hormones
B6	Pyridoxine, Pyridoxamine, Pyridoxal	Anaemia and peripheral neuropathy	Formation of red blood cells
B7	Biotin	Dermatitis and inflammation of the intestines	Allows the body to metabolize proteins, fats and carbohydrates
B9	Folic acid, Folinic acid	Neurological problems and certain anaemias	Important for a healthy nervous system
B12	Cyanocobalamin, Hydroxocobalamin, Methylcobalamin	Neurological problems and some types of anaemia	Maintaining a healthy neurological system
C	Ascorbic acid	Scurvy, causing gum bleeding, tooth loss, poor tissue growth, and wound healing	Collagen production, wound healing, bone formation, strengthens blood vessels, boosts the immune system, aids iron absorption and functions as an antioxidant
D	Ergocalciferol, Cholecalciferol.	Rickets, osteomalacia	Required for healthy bone calcification
E	Tocopherol, Tocotrienol	Hemolytic anemia in infants.	Its antioxidant properties help prevent oxidative stress, a problem that increases the risk of widespread inflammation and various illnesses
K	phylloquinone, menaquinone	bleeding diathesis, or an unusual proclivity to bleed	Necessary for blood clotting

Vitamins and their correlation with COVID-19:

Vitamin D is a fat-soluble steroid hormone precursor produced by UVB (UVB) radiation from 7-dehydrocholesterol (7DHC) in the epidermis of the skin and is converted to the circulating precursor cholecalciferol. In the liver, cholecalciferol is hydroxylated to 25-hydroxyvitamin D, and in the kidney, it is converted to the active hormone 1,25-hydroxyvitamin D (1,25 (OH) 2D). Vitamin D plays a role in a variety of body systems, including both innate and adaptive immune responses. Vitamin D promotes monocyte-to-macrophage differentiation while increasing superoxide production, phagocytosis, and bacterial destruction. In addition, vitamin D can regulate the adaptive immune response by suppressing the function of T helper type 1 (Th1) cells and reducing the production of the inflammatory cytokine IL2 and interferon-gamma (INFγ). Deficiency in vitamin D has been suggested to increase the incidence and severity of COVID-19 infection. Patients with COVID-19 have been repeatedly shown to have low vitamin D levels and half the mean plasma concentration of the control, but the choice of the study cohort is unclear and unmatched compared to the major confounders. The conclusion is unclear. Therefore, vitamin D supplementation has been proposed to boost immunity to COVID-19 and reduce human mortality. It has also been suggested that adequate levels of vitamin D may help protect the respiratory epithelium from pathogen invasion and reduce the risk of infection. Evidence has shown directly that the mortality rate is higher in COVID-19 patients with vitamin D deficiency and the mortality rate is lower in Nordic countries (Norway, Sweden, Iceland, Finland, Greenland and Denmark) possibly because of the rarity of vitamin D deficiency due to widespread supplement use **[2]**.

Vitamin C or ascorbic acid is a water-soluble nutrient that humans cannot synthesize. Vitamin C removes reactive oxygen species (ROS), thereby acting as an antioxidant that protects biomolecules such as proteins, lipids, and nucleotides from oxidative damage and dysfunction. Vitamin C accumulates in white blood cells at a concentration 50100 times higher than the plasma and used immediately at the time of infection. The imbalance between antioxidant defense and oxidant formation can alter multiple signalling pathways involving pro-inflammatory transcription factors such as the nuclear factor κB (NFκB). NFκB is involved in inflammatory reactions, the etiology of certain diseases, and viral infections. Vitamin C is known to have a preventive effect on infectious diseases. Interestingly, patients with acute

respiratory infections such as pneumonia and tuberculosis have lower plasma vitamin C levels, and vitamin C administration reduces the severity and duration of pneumonia in older patients. This important protective effect against respiratory infections is an interesting target for COVID-19 **[2]**.

Antioxidant Vitamin E and the trace element selenium are important components of antioxidant defense. Epidemiological studies have shown that a deficiency of any of these nutrients alters the virus's immune response and pathogenicity. It has been found that there is a correlation between geographic selenium levels and COVID-19 cure rates in various states of China **[2]**.

Long term COVID-19 complications:

Post-acute COVID-19 syndrome defined if people affected with COVID-19 infection and after recovery, they may experience these severe complications apart from other post-COVID symptoms, and Myocardial infarction, Chronic fatigue syndrome, Deep vein thrombosis, Neurological symptoms, Pancreatitis, Haemothorax, Pneumothorax, Pulmonary fibrosis, Arthritis, Fungal infections like mycormycosis, aspergillosis, yellow fugus et cetera can be included **[3]**.

COVID-19 can also weaken blood vessels, leak blood vessels, and prolong liver and kidney problems. Many people who recover from COVID-19 can develop chronic fatigue syndrome. A complex disorder characterized by extreme fatigue that is exacerbated by physical or mental activity but not relieved by rest. Although the long-term effects of the Coronavirus is difficult to predict **[3]**.

Long-term organ damage in COVID-19:

Conditions associated with long-term COVID-19 infections can result from damage to multiple organs such as the lungs, brain, blood vessels, skin, nerves, kidneys, and heart. Organ damage can increase the risk of long-term health problems. According to recent data, COVID-19 mainly affects these organs and body parts.

Lungs- COVID-19 related pneumonia can cause long-term damage to the small alveoli of the lungs where the lungs and blood exchange oxygen and carbon dioxide between inhalation and exhalation. Scar tissue in the lungs can cause long-term respiratory problems **[3]**.

Heart- Patients with heart disease after recovery from COVID-19 showed irreversible tissue death of the myocardium. This increases the risk of myocardial infarction and can lead to heart failure and other heart-related life-threatening complications in the future **[3]**.

Brain- Many reports that young people with COVID-19 show neurological symptoms such as weakness, tingling, and numbness in the limbs, eventually causing

paralysis, dizziness, sudden fainting, confusion, delirium, and seizures. COVID-19 may also increase the risk of developing Alzheimer`s disease and Parkinson`s disease **[3]**.

Kidney- Kidney patients affected with COVID-19 can develop sudden loss of kidney function, known as acute kidney injury. People with CKD are at higher risk of developing severe symptoms post COVID-19 recovery **[3]**.

METHODS AND MATERIALS

15 published articles were taken in this study. By using "vitamins" and "covid-19" keywords, the available literature on the significance of vitamins in covid-19 was searched through a different online database [Pubmed, science direct, etc…]. Inclusion criteria: onset of Covid-19.

CASEWISE DESCRIPTION OF VITAMINS' EFFECT ON COVID-19:

Case 1: Given the scale of the pandemic, larger clinical trials provide a stronger correlation between vitamin D status, inflammation, the severity of respiratory illness, and COVID-19 mortality. It is also a safe, inexpensive, and readily available option to improve the results of COVID-19 in at-risk individuals. We have evidence-based support for vitamin D supplementation and potential new therapeutic targets for reducing inflammation and ARDS in SARS-CoV2 and other respiratory infections **[4]**.

Case 2: In this context, the dual role of vitamin D, which first controls viral replication and later reduces hyperinflammation, is compelling. This is consistent with the observation that low vitamin D levels can adversely affect outcomes in patients with COVID-19. Given that vitamin D has been shown to be effective against certain viral respiratory infections, including COVID-19. Vitamin D supplements are relatively cheap, safe, and widely available as supplements **[5]**.

Case 3: Athletes and related people can benefit from improved athletic performance, improved health, and reduced risk of COVID-19 by maintaining serum 25(OH)D levels above 40 ng/ml. Achieving this level may require supplementation with vitamin D3, perhaps 4000-10,000 IU / day, depending on body size, skin pigmentation, and other personal factors. The administration of 10,000 IU/day improves serum levels of vitamin D for several months. Vitamin D supplementation helps reduce the risk and severity of COVID-19, but it is not the only means used. Athletes must also follow official guidelines in connection with wearing a mask, social distance, and regular testing **[6]**.

Case 4: Vitamin C treats acute respiratory infections and relieves inflammation in critical COVID-19 patients by intravenous infusion of vitamin C which corrects disease-related deficiencies, and reduces

inflammation. There are potential benefits in increasing production and supporting anti-inflammatory drugs. People in the group with high COVID-19 mortality and risk of vitamin C deficiency should always be supplemented with vitamin C daily and doses up to 6-8 g/day to ensure adequate vitamin C adequacy **[7]**.

Case 5: No side effects of short-term use of vitamin C at high doses have been reported. Therefore, given the pharmacological properties of vitamin C and its safety profile at high doses, we suggest including vitamin C in the COVID-19 treatment protocol, especially if this is ongoing. RCTs registered with clinicaltrials.gov will show positive results in the near future **[8]**.

Case 6: The antioxidant and anti-inflammatory effects of vitamin B12 may help prevent the progression of multiple organ failure and thus COVID-19 complications. Vitamin B12 deficiency needs to be actively treated, especially in the elderly and diabetics. Strengthen individuals' ability to combat COVID-19 by preventing undernourishment, identifying individuals at high risk of malnutrition, and implementing safe and effective dietary guidelines, especially in developing countries such as India **[9]**.

Caes 7: In general, serum levels of 25 (OH) D, vitamin B12, especially zinc at admission appear to have an impact on the clinical outcome of patients with COVID-19. Based on the results presented here, further studies (epidemiological studies, intervention studies and clinical studies) to determine the benefits of vitamin D, vitamin B12, especially zinc or combinations thereof in COVID-19 disease and characterize the course. Studies) suggest that it is necessary and clinical outcomes **[10]**.

Case 8: As can be seen from various studies, vitamin C, vitamin D, zinc, and selenium deficiencies can be considered dietary risk factors for patients with COVID-19. The immune dysfunction observed in the pathogenicity of COVID-19 can be exacerbated or diminished depending on the nutritional status of the host **[11]**.

Case 9: The biological information and calculation results of this study highlight the role of vitamin A in antiviral, anti-inflammatory, and immunomodulatory effects via various biological processes and cellular signalling pathways, as shown by network pharmacological analysis. More importantly, VA can be used clinically to treat COVID-19, as evidenced by identified biological processes exhibiting pharmacological function and signalling pathways indicating therapeutic mechanisms **[12]**.

Case 10: The current review is investigating the potential of vitamin A in Megadose as an affordable additional

therapy for COVID-19 disease with minimal reversible side effects. It provides insights into the association between the effects of vitamin A on airway ACE-2 expression and the prognosis of patients with COVID-19. Vitamin A supplementation may help generate a protective immune response against the Covid-19 vaccine. An overview of vitamin A doses and safety profiles is provided, along with recommended doses for prophylactic/therapeutic use in randomized controlled trials in Covid-19 patients [13].

Case 11: This study confirms that serum vitamin D deficiency is associated with more severe lung lesions, longer disease duration, and risk of death in elderly COVID-19 patients. The detection of low vitamin D levels in young COVID-19 patients with few comorbidities further indicates vitamin D deficiency as a major risk factor for all ages **[14]**.

Case 12: The effects of vitamins C, D, E, zinc, selenium, and omega 3 fatty acids on the immune system and the potential benefits for people suffering from COVID-19 have been shown. These are particularly relevant to vulnerable older people and represent an imbalanced burden of morbidity and mortality during these periods. All the nutrients mentioned playing a meaningful role in supporting patients with COVID19. Supplementing with high doses of vitamins D, C, and zinc may have beneficial effects during COVID19 infection **[2]**.

Case 13: At the onset of acute COVID-19, both vitamin K deficiency and vitamin D deficiency were independently associated with worsening severity of COVID-19 disease, even after considering demographics and comorbidities. This suggests a possible synergistic interaction between these two vitamins contained in COVID-19 as an important modifiable risk factor **[15]**.

Case 14: A possible association between decreased vitamin K levels and severe cases of COVID-19 has recently been reported. The multiple diverse roles of vitamin K in regulating blood coagulation, elastin degradation, immunoregulation, and managing vascular health, along with the low toxicity of vitamin K in humans, supplementally or therapeutically use vitamin K. At the end we can conclude that it can be used when its needed and is moderately useful in treating covid symptoms **[16]**.

Case 15: The lung is a major target organ for SARSCoV2 infection, information on the role of vitamins in lung health is very limited. With the advent of new viruses, nutritional studies need to be conducted on the lungs, which are the main target of aerial viral infections. Severe vitamin B6 deficiency is relatively rare, but some people have a mild vitamin B6 deficiency.

Vitamin B6 has few costs and health risks and is readily available as a dietary supplement but its effectiveness compared to other vitamins in treating covid-19 conditions is less **[17]**.

RESULT

After studying all the above cases, we can say that few of them are highly effective, few are moderately effective and few are very less effective in the symptomatic relief of the covid-19 condition which can be easily identified by the below table **(Table 2)**.

Table-2: Vitamins and their effect on covid-19 condition

Vitamins	Effectiveness in severe COVID-19 condition
Vitamin B12 **Vitamin A** **Vitamin C** **Vitamin D** **Vitamin E**	**Highly effective**
Vitamin K **Vitamin B6** **Vitamin B9**	**Moderately effective**
Vitamin B1 **Vitamin B2** **Vitamin B3** **Vitamin B5** **Vitamin B7**	**Less effective**

DISCUSSION

Here, some of the cases have been reviewed and in most of the cases; vitamin A, B12, C, D and E are highly effective in the treatment of covid-19 as compared to other vitamins. Whereas Vitamin K, B6, B9 and vitamin B1, B2, B3, B5, B7 are respectively moderate and less effective. While in the study conducted by Kumar, P., Kumar, M., Bedi, O. *et al,* concluded that adequate supplementation of vitamin A, B, C, D, E, K and other micronutrients can provide improvement to the covid-19 condition **[18]**.

CONCLUSION

By gathering all the information from the above cases, we can conclude that among all the vitamins; vitamin A, vitamin B12, vitamin C, vitamin D, and vitamin E are highly effective; vitamin K, vitamin B6, and vitamin B9 are moderately effective; and vitamin B1, vitamin B2, vitamin B3, vitamin B5, and vitamin B7 are less effective in severe COVID-19 conditions.

REFERENCES

[1] Brazier Y. Vitamins: What are they, and what do they do? [Internet]. Medicalnewstoday.com. 2020 [cited 2022 Apr 13].

[2] Shakoor H, Feehan J, Al Dhaheri AS, Ali HI, Platat C, Ismail LC, et al. Immune-boosting role of vitamins D, C, E, zinc, selenium and omega-3 fatty acids: Could they help against COVID-19? Maturitas

[Internet]. 2021 [cited 2022 Apr 13];143:1–9.

[3] Post COVID Complications, Long term effects of Coronavirus after recovery, pace hospital,2021 [Internet].

[4] Kalia V, Studzinski GP, Sarkar S. Role of vitamin D in regulating COVID-19 severity-An immunological perspective. J Leukoc Biol [Internet]. 2021;110(4):809–19.

[5] Mohan M, Cherian JJ, Sharma A. Exploring links between vitamin D deficiency and COVID-19. PLoS Pathog [Internet]. 2020;16(9):e1008874.

[6] Grant WB, Lahore H, Rockwell MS. The benefits of vitamin D supplementation for athletes: Better performance and reduced risk of COVID-19. Nutrients [Internet]. 2020;12(12):3741.

[7] Holford P, Carr AC, Jovic TH, Ali SR, Whitaker IS, Marik PE, et al. Vitamin C-an adjunctive therapy for respiratory infection, sepsis and COVID-19. Nutrients [Internet]. 2020;12(12):3760.

[8] Abobaker, A., Alzwi, A., & Alraied, A. H. A. (2020b). Overview of the possible role of vitamin C in management of COVID-19. *Pharmacological Reports: PR*, *72*(6), 1517–1528.

[9] Rai, S., Sindhu, Prajna, Rai, B. S., & Pakkala, P. R. (2021). The potential role of vitamin B12 in the prevention of COVID-19 complications: A narrative review. *Journal of Pure & Applied Microbiology*, *15*(4), 1735–1744.

[10] Shakeri, H., Azimian, A., Ghasemzadeh-Moghaddam, H., Safdari, M., Haresabadi, M., Daneshmand, T., & Namdar Ahmadabad, H. (2022). Evaluation of the relationship between serum levels of zinc, vitamin B12, vitamin D, and clinical outcomes in patients with COVID-19. *Journal of Medical Virology*, *94*(1), 141–146.

[11] Pedrosa, L. F. C., Barros, A. N. A. B., & Leite-Lais, L. (2022). Nutritional risk of vitamin D, vitamin C, zinc, and selenium deficiency on risk and clinical outcomes of COVID-19: A narrative review. *Clinical Nutrition ESPEN*, *47*, 9–27.

[12] Li, R., Wu, K., Li, Y., Liang, X., Tse, W. K. F., Yang, L., & Lai, K. P. (2020). Revealing the targets and mechanisms of vitamin A in the treatment of COVID-19. *Aging*, *12*(15), 15784–

15796. https://doi.org/10.18632/aging.103888Midha IK, Kumar N, Kumar A, Madan T. Mega doses of retinol: A possible immunomodulation in Covid-19 illness in resource-limited settings. Rev Med Virol [Internet]. 2021;31(5):1–14.

[13] Midha IK, Kumar N, Kumar A, Madan T. Mega doses of retinol: A possible immunomodulation in Covid-19 illness in resource-limited settings. Rev Med Virol [Internet]. 2021;31(5):1–14.

[14] Sulli A, Gotelli E, Casabella A, Paolino S, Pizzorni C, Alessandri E, et al. Vitamin D and lung outcomes in elderly COVID-19 patients. Nutrients [Internet]. 2021;13(3):717.

[15] Desai AP, Dirajlal-Fargo S, Durieux JC, Tribout H, Labbato D, McComsey GA. Vitamin K & D deficiencies are independently associated with COVID-19 disease severity. Open Forum Infect Dis [Internet]. 2021 [cited 2022 Apr 13];8(10):ofab408.

[16] Kudelko M, Yip TF, Hei Law GC, Lee SMY. Potential beneficial effects of vitamin K in SARS-CoV-2 induced vascular disease? Immuno [Internet]. 2021;1(1):17–29.

[17] Kumrungsee T, Zhang P, Chartkul M, Yanaka N, Kato N. Potential role of vitamin B6 in ameliorating the severity of COVID-19 and its complications. Front Nutr [Internet]. 2020;7:562051.

[18] Kumar P, Kumar M, Bedi O, Gupta M, Kumar S, Jaiswal G, et al. Role of vitamins and minerals as immunity boosters in COVID-19. Inflammopharmacology [Internet]. 2021 [cited 2022 Apr 27];29(4):1001–16.