

Are Vitamin D Levels Associated with COVID-19 Prevalence and Outcomes?

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ABSTRACT

Since December 2019, coronavirus infection disease-2019 (COVID-19) due to a new coronavirus, severe acute respiratory syndrome type 2 (SARS-CoV2) infection, occurred mainly in Wuhan City, Hubei Province, China, and spread worldwide throughout a short period of time. The COVID-19 pandemic is shaking the world. To date, the route of infection, treatment methods, and the process since infection have not been clarified. Therefore, various researches and studies are being carried out at a rapid pace in research institutions around the world to clarify the novel coronavirus. Vitamin D helps to balance calcium and helps maintain bone health. Vitamin D is considered to be physiologically effective for enhancing immunity, cancer, diabetes, autism, and making the body easy to conceive. Recent studies have reported an association between the amount of vitamin D in the body and the severity of COVID-19. In this review, we provide a compact, comprehensive description of the relationship between vitamin D and COVID-19.

The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing pandemic of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. The outbreak was first identified in Wuhan, China, in December 2019 [2,3]. The World Health Organization declared the outbreak a Public Health Emergency of International Concern on 30 January, and a pandemic on 11 March [4,5]. As of 2 June 2020, more than 6.25 million cases of COVID-19 have been reported in more than 188 countries and territories, resulting in more than 375,000 deaths; more than 2.69 million people have recovered [6]. At academic conferences, etc., the effectiveness of vitamin D for prevention and reduction of mortality against new coronavirus infection disease-2019 (COVID-19) has been debated. Two new data were recently reported to support the anti-COVID-19 effects of vitamin D.

The first finding was reported by British researchers in the online version of "Aging Clinical and Experimental Research"

on May 6th 2020 [7]. The relationship between the mean vitamin D levels in the body and the effect on COVID-19 was examined for 20 European countries. As a result, a negative correlation was found that COVID-19 morbidity and mortality were low in people with high levels of vitamin D in the body [7] (Figure 1). In Southern Europe such as Italy and Spain, it is considered that the amount of vitamin D synthesized is low because the skin pigment is dark. Meanwhile, the researchers think that many Nordic people take liver oil and vitamin D supplements.

The second research result was published on April 10th 2020 in the online version of "medRxiv". This paper has not been peer reviewed [8]. Dr. Ali Daneshkhan and colleagues at Northwestern University analyzed data on vitamin D levels in the body of people from 10 countries including the United States. In this report, it was said that a low vitamin D level in the body was associated with an excessive immune response [8]. The results of this study explain why childhood mortality from COVID-19 is low. Also, some questions related to COVID-19 are explained in this report (8).

But Dr. Mark Bolland at the University of Auckland (New Zealand) points out that neither study supports a causal link. Many research results have been reported showing the association between low vitamin D levels and disease progression. However, increasing the vitamin D level in the body does not improve the medical condition. In some countries with low mean vitamin D levels in the body, low mean vitamin D levels may contribute to COVID-19 morbidity and mortality. However, many clinical trials are needed for the hypothesis to be substantiated.

Meanwhile, Dr. William Grant at the Center for Sunlight, Nutrition and Health Research in the US gives a different view. The results of this research indicate that vitamin D may be effective in preventing COVID-19 and preventing its severity. Dr. Frank Lau at Louisiana State University has also confirmed that vitamin D protects against COVID-19 in clinical studies. Vitamin D may enhance the immune response to COVID-19 and help generate antibodies to SARS-

CoV-2. Vitamin D may help prevent systemic infection of SARS-CoV-2.

In these medical discussions, multiple clinical trials are set to begin to examine the effect of vitamin D on preventing the aggravation of COVID-19. Dr. Lau's clinical trial is investigating the anti-COVID-19 effects of vitamin D in patients with early-stage COVID-19 symptoms. On the other hand, a clinical trial conducted in France will examine the anti-COVID-19 effect of vitamin D in critically ill patients with COVID-19.

Conclusion

Previous studies have shown that low average levels of vitamin D are susceptible to acute respiratory infections. In COVID-19, it is reported that patients with COVID-19 die from the onset of acute respiratory distress syndrome (ARDS) due to excessive release of inflammatory cytokines. Recent research reports indicate that vitamin D regulates leukocyte responses and prevents releasing excessive inflammatory cytokines from leukocytes. In other words, vitamin D seems to have the effect of suppressing the excessive immune response and suppressing the occurrence of the inflammatory cytokine storm. The British National Health Service recommends that adults consume approximately 10 micrograms of vitamin D daily (e.g. one egg contains 2 micrograms of vitamin D). It is important to actively eat foods rich in vitamin D, such as fish and mushrooms, as well as to enhance the normal immunity by being exposed to sunlight that stimulates the natural production of vitamin D.

Footnote

Vitamin D is a group of fat-soluble secosteroids responsible for increasing intestinal absorption of calcium, magnesium, and phosphate, and multiple other biological effects [9]. In humans, the most important compounds in this group are vitamin D₃ (also known as cholecalciferol) and vitamin D₂ (ergocalciferol) [10].

The major natural source of the vitamin is synthesis of cholecalciferol in the lower layers of skin epidermis through a chemical reaction that is dependent on sun exposure (specifically UVB radiation) [11,12].

Disclosure of potential conflicts of interest

The authors declare no potential conflicts of interest. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Author Contributions

T.H. performed most of the experiments and coordinated the project; T.H. conceived the study and wrote the manuscript. I.K. gave information on clinical medicine and oversaw the entire study.

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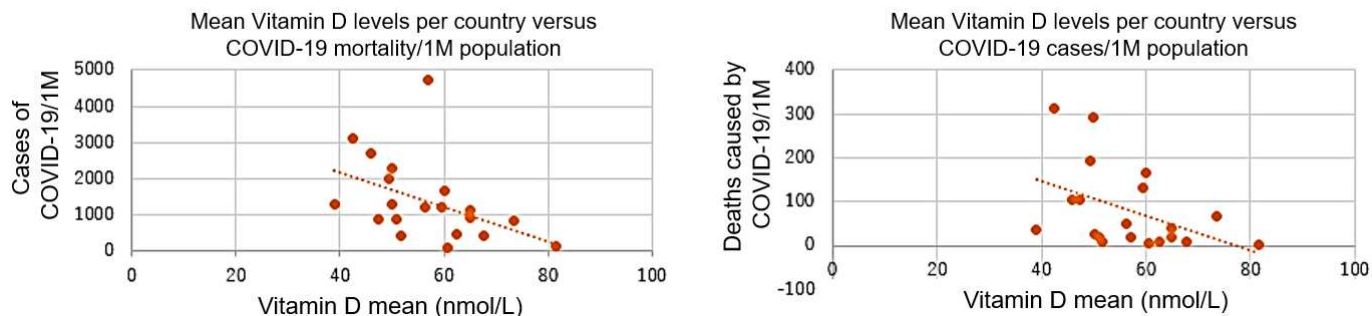


Figure1. Mean vitamin D levels per country versus COVID-19 cases and mortality/1M population

The negative correlation is found that COVID-19 morbidity and mortality were low in people with high concentration levels of vitamin D in the body. The modified figure 1 is adapted from doi: 10.1007/s40520-020-01570-8.

