ABSTRACT

Implications of Vitamin D Levels in COVID-19 Morbidity and Mortality

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SUMMARY

Recent research shows relationships between optimal vitamin D levels and better outcomes in COVID-19. Vitamin D is a hormone required for healthy bones. When its levels in the blood drop below 25 nmol/L, one is vitamin D deficient. Insufficiency is when blood vitamin D levels are below 75 nmol/L. 70% of the US population are vitamin D deficient, while 30% are vitamin D insufficient. This study analyzes three articles revealing associations between vitamin D levels and risk of death and severe health complications from COVID-19 in adults. Maghbooli et al. (2020) reports that vitamin D sufficient patients had lower risks than deficient patients of severe COVID-19 complications. A study by Raharushun et al. (2020) finds 98.9% of vitamin D deficient COVID-19 patients and 88% with vitamin D insufficiency died. Only 4% of sufficient individuals died. Meltzer et al. (2020) reports higher rates of COVID-19 in vitamin D deficient compared to sufficient groups. Vitamin D sufficiency may activate the immune system’s antiviral response. Vitamin D binds to immune cells, stimulating the production of an antibacterial protein. More studies should examine vitamin D sufficiency as a potential mitigator in COVID-19 consequences.

ABSTRACT

Vitamin D is a steroid hormone known for maintaining bone health. Vitamin D deficiency is a 25-hydroxyvitamin D (25(OH)D) serum concentration below 25 nmol/L. In contrast, vitamin D insufficiency occurs at levels below 75 nmol/L.¹ Vitamin D insufficiency and deficiency affect 70% and 30% of the US population, respectively.¹ Emerging evidence associates optimal vitamin D levels with better clinical outcomes in COVID-19.² This literature review analyzed three preliminary articles that explored associations between vitamin D levels, COVID-19 mortality, and risk of adverse clinical outcomes in adult hospitalized patients.³⁻⁵ Google Scholar was used to find studies that diagnosed COVID-19 with reverse transcription (RT-PCR). In a cross-sectional analysis, Maghbooli et al. (2020) reported that vitamin D sufficient patients had a significantly lower chance (9.7%, n=77, p=0.01) of severe COVID-19 complications than deficient patients (32.8%, n=158, p=0.01).³ This study is under review for diagnosis accuracy and sample size. A retrospective cohort study by Raharushun et al. (2020), which included active and expired cases (n=780), found that 98.9% (p<0.001) of vitamin D deficient COVID-19 patients and 88% (p<0.001) with insufficiency died, but only 4% of sufficient individuals died.⁵ Lastly, a retrospective cohort study by Meltzer et al. (2020) reported higher rates of COVID-19 infection, 21.6% (95% CI, 14.0-29.2%), in vitamin D deficient groups (n=172), compared to 12.2% (95% CI, 8.5-15.4%) in sufficient groups (n=327).⁴ The 25(OH)D levels were measured within one year of COVID-19 testing.⁴ All studies controlled for age, sex, and comorbidities, while the first controlled for BMI and smoking, and the third controlled for race.³⁻⁵ Vitamin D sufficiency may activate the innate and adaptive immune systems, leading to an antiviral response.⁶⁻⁷ Receptor binding of vitamin D on neutrophils and macrophages stimulates cathelicidin expression, an antibacterial peptide.⁷ Macrophage and T-regulatory cell quantities also increase.⁷ These results reveal the need for randomized controlled studies of vitamin D sufficiency as a potential mitigator in COVID-19 outcomes.

Keywords: Vitamin D deficiency, vitamin D insufficiency, vitamin D sufficiency, COVID-19 mortality, COVID-19 morbidity

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