

Study of serum vitamin d levels in Covid-19 patients; A cross sectional study

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Abstract

Background: A COVID-19 outbreak is a global pandemic that has caused an immeasurable impact on our communities. Taking into account the amount of health and economic burden it has caused, it is important to improve the condition of patients by accelerating recovery and to reduce the risk of deterioration. There are number of studies stating the role of vitamin D levels in improving the general condition of COVID-19 patients. Hence, this study has been done to find the relationship between serum vitamin D levels and disease severity in COVID-19.

Aims and Objectives: (1) to estimate the prevalence of vitamin D deficiency and insufficiency in patients with COVID-19. (2) to compare the serum vitamin D levels with severity of the disease in COVID-19.

Materials and methods: It is a cross sectional study carried out at KVG Medical College, Sullia, Dakshina Kannada, Karnataka during the period from July 2020 to September 2020. 50 patients aged more than 18 years and diagnosed with COVID-19 were included in the study after applying inclusion and exclusion criteria.

Results: In our study, though there was high prevalence of vitamin D deficiency among study participants but there was significant statistical relationship between the serum vitamin D levels and severity of the disease assessed using serum C-reactive protein (CRP), serum lactate dehydrogenase (LDH), serum ferritin and serum D-dimer levels.

Conclusion: Vitamin D deficiency and insufficiency is highly prevalent in COVID-19 patients but its serum levels did not correlate with the markers of disease severity.

Keywords: serum Vitamin D, Covid-19 patients, severity disease

Introduction

A COVID-19 outbreak is a global pandemic that has caused an immeasurable impact on our communities. Taking into account the amount of health and economic burden it has caused, it is important to improve the condition of patients by accelerating recovery and to reduce the risk of deterioration. There are number of studies stating the role of vitamin D levels in improving the general condition of COVID-19 patients. Hence, this study has been done to find the relationship between serum vitamin D levels and disease severity in COVID-19.

Vitamin D belongs to a group of fat-soluble steroids which is synthesized in the skin upon exposure to sunlight and is then hydroxylated in the liver to 25 hydroxy vitamin D followed by another hydroxylation to 1, 25 dihydroxy vitamin D which is the most active form of vitamin D. 1, 25 dihydroxy vitamin D is responsible for increasing intestinal absorption of calcium, magnesium, phosphate, and many other biological effects.

Serum vitamin D level ranges from 30 – 50 ng/mL. Levels between 20-30 ng/mL is considered as “insufficiency” and levels <20 ng/mL is considered as “deficiency”.

A study done by Pereira M, *et al* in Brazil in November 2020 observed that, there is high prevalence of vitamin D deficiency and insufficiency in patients diagnosed with COVID-19 [1].

Aims Objectives

1. To estimate the prevalence of vitamin D deficiency and

insufficiency in patients with COVID-19

2. To compare the serum vitamin D levels with severity of the disease in COVID-19.

Materials and Methods

It is a cross sectional study carried out in the department of General Medicine at KVG Medical College, Sullia, Dakshina Kannada, Karnataka during July 2020 to September 2020.

Study was carried out on 50 patients after meeting the inclusion and exclusion criteria.

Inclusion Criteria

- Patients diagnosed with SARS-COV2.
- Patients above 18 years of age.

Exclusion criteria

- Patients on vitamin D supplementation
- Patients with any of the co-morbidities
- Patient with history of alcohol intake

During the data collection detailed history and relevant examination were done according to the proforma while wearing PPE kit. Patients were categorized into 3 categories as per the COVID-19 protocol issued by the Government of Karnataka which is as follows:

- **Category A:** Asymptomatic patients/ patients with mild symptoms.
- **Category B:** Symptomatic patients with mild to moderate pneumonia with no signs of severe disease

(respiratory rate: 15-30 cycles per min or SpO₂: 90-94% at room air).

- **Category C:** Symptomatic patient with severe pneumonia with respiratory rate >30 cycles per min or SpO₂ less than 94% with oxygen, acute respiratory distress syndrome (ARDS) or septic shock.

Blood levels of CRP, ferritin, LDH, D-dimer and total leucocyte count were tested. 221 COVID-19 patients were screened. Out of these, 171 patients were excluded as per the

exclusion criteria and remaining 50 patients were included in the study.

Results

The study included 50 patients admitted during 3 months of study period and among them 28 were males and 22 were females. Upon categorising according to the severity of the disease, there were 20 patients in category A, 25 patients in category B and 5 patient in category C.

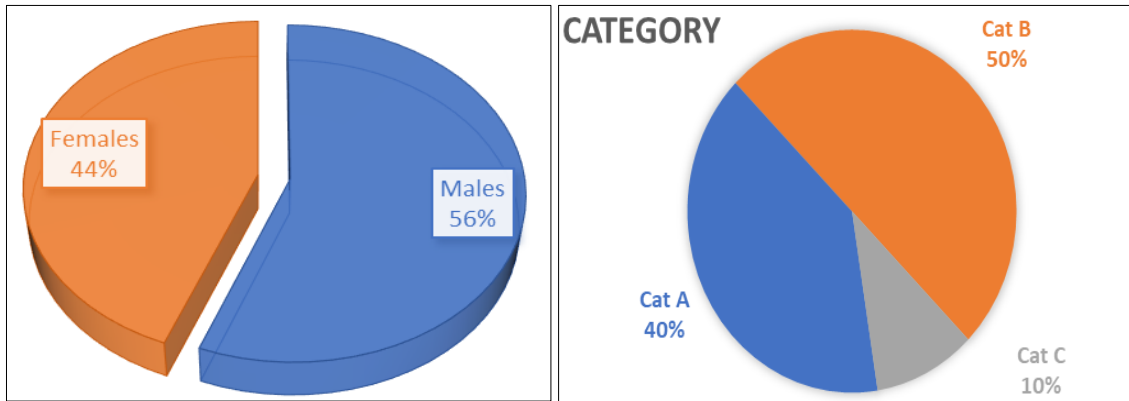


Fig 1

Among the study population, 39 patients had vitamin D levels below 20 ng/mL (78%), 8 patients were having vitamin D levels between 20 ng/mL to 30 ng/mL (16%) and only 3 patients were having normal vitamin D levels (6%). The mean Vitamin D levels among all patients were 15.36 ng/mL. Vitamin D level was compared with CRP level using Pearson

correlation and R value was found to be -0.0094 and a P value of 0.957 which was statistically insignificant. Similarly, there was statistically significant relationship between vitamin D levels and serum ferritin (R value: -0.138, P value: 0.408), serum LDH (R value: -0.030, P value: 0.858) and D-dimer (R value: -0.031, P value: 0.853) levels.

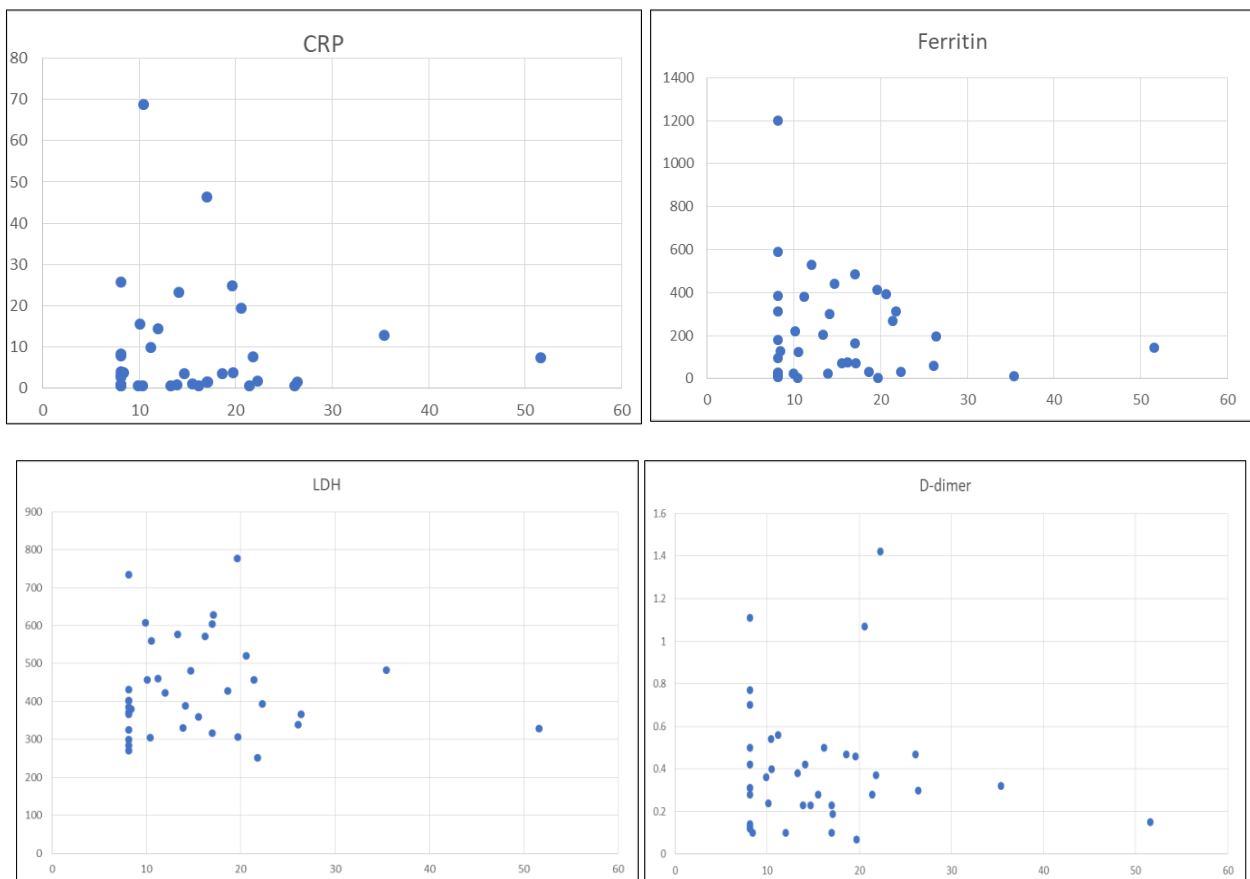


Fig 2

Discussion

In this study, we observed that the mean vitamin D level was 15.36 ng/mL, which is similar to the finding of a study done by Jain A *et al* in November 2020, where severe COVID-19 patients had a mean vitamin D level of 14.35 ± 5.79 ng/mL^[2]. But, it is noteworthy that a substantial population of India (approximately >70%) are vitamin D deficient (<20 ng/ml)^[3].

In a study by F. M. Panfili *et al*, vitamin D proved to interact both with the innate immune system, by activating Toll-like receptors (TLRs) or increasing the levels of cathelicidins and β -defensins, and adaptive immune system, by reducing immunoglobulin secretion by plasma cells and pro-inflammatory cytokines production, thus modulating T cells function^[4].

In a study done by Fawaz Azizieh *et al* in April 2016, there was no significant direct correlations between serum levels of vitamin D and any of the inflammatory markers measured. However, subjects with deficient levels of vitamin D and high CRP produced significantly higher levels of the proinflammatory cytokines (TNF- α and IL-8) as compared to subjects with low CRP levels with non-deficient and deficient levels of vitamin D^[5].

In a study done by Funda Tamer, *et al* in 2019, it was observed that decreased serum levels of ferritin and 25-hydroxyvitamin D were more prevalent in patients with recurrent aphthous stomatitis compared to healthy individuals indicating that mucosal integrity requires vitamin D.⁶ Hence, vitamin D deficiency theoretically increases the risk of viremia in Covid-19 due to poor mucosal integrity.

In another study done by Manion M *et al*, it was observed that Covid-19 patients with vitamin D deficiency, when compared to those with insufficient or normal vitamin D levels, had increased blood levels of D-dimer^[7].

Though, there is insufficient evidence on the association between vitamin D levels and COVID-19 severity and mortality, lower circulating 25(OH) vitamin D concentrations been reported to associate with susceptibility to SARS-CoV-2 infection^[8] and COVID-19 Severity^[9].

In a recent study by Ali N *et al*, in June 2020 found that, vitamin D supplementation has protective effects against respiratory tract infections^[10]. Also, study done by Ebadi M *et al*, in May 2020 showed an inverse association of vitamin D levels in patients diagnosed with SARS-COV2. There was high prevalence of vitamin D deficiency in COVID-19 patients and improving the vitamin D level in those patients had potentially improved the clinical status and prognosis.¹¹

Also in a study by Pereira M *et al*, in November 2020, they observed a positive association between vitamin D deficiency and the severity of the disease. They identified that severe cases of COVID-19, presented with severe vitamin D deficiency as compared with mild cases. Also, vitamin D deficiency increased hospitalization and mortality from COVID-19^[11]. In this study, though there was high prevalence of vitamin D deficiency among study subjects but upon comparing with the severity of the disease using serum levels of CRP, LDH, Ferritin and D-dimer, vitamin D levels did not show any significant correlation with disease severity. However, further studies are required with higher sample size to overcome the limitations of our study and to refute the absence of correlation between vitamin D level and disease severity.

Conclusion

Vitamin D deficiency and insufficiency is highly prevalent in COVID-19 patients but its serum levels did not correlate with the markers of disease severity.

Reference

- Pereira M, Dantas Damascena A, Galvão Azevedo LM, de Almeida Oliveira T, da Mota Santana J. Vitamin D deficiency aggravates COVID-19: systematic review and meta-analysis. *Critical reviews in food science and nutrition*, 2020, 3:1-9.
- Jain A, Chaurasia R, Sengar NS, Singh M, Mahor S, Narain S *et al*. Analysis of vitamin D level among asymptomatic and critically ill COVID-19 patients and its correlation with inflammatory markers. *Scientific reports*. 2020; 10(1):1-8.
- Aparna P, Muthathal S, Nongkynrih B, Gupta SK, Vitamin D. deficiency in India. *Journal of family medicine and primary care*. 2018; 7(2):324.
- Panfili FM, Roversi M, D'Argenio P, Rossi P, Cappa M, Fintini D *et al*. Possible role of vitamin D in Covid-19 infection in pediatric population. *Journal of endocrinological investigation*. 2020; 15:1-9.
- Azizieh F, Alyahya KO, Raghupathy R. Association between levels of vitamin D and inflammatory markers in healthy women. *Journal of inflammation research*. 2016; 9:51.
- Tamer F, Avci E. Decreased serum ferritin and vitamin D levels in patients with recurrent aphthous stomatitis. *Our Dermatol Online*. 2019; 10:229-33.
- Manion M, Hullsiek KH, Wilson EM, Rhame F, Kojic E, Gibson D *et al*. Sereti I. Vitamin D deficiency is associated with IL-6 levels and monocyte activation in HIV-infected persons. *PLoS One*. 2017; 12(5):e0175517.
- D'Avolio A, Avataneo V, Manca A, Cusato J, De Nicolò A, Lucchini R, Keller F *et al*. 25-Hydroxyvitamin D concentrations are lower in patients with positive PCR for SARS-CoV-2. *Nutrients*. 2020; 12(5):1359.
- Panagiotou G, Tee SA, Ihsan Y, Athar W, Marchitelli G, Kelly D *et al*. Macfarlane J, Martineau AR, Burns G. Low serum 25-hydroxyvitamin D (25 [OH] D) levels in patients hospitalized with COVID-19 are associated with greater disease severity. *Clinical endocrinology*. 2020; 93(4):508-11.
- Ali N. Role of vitamin D in preventing of COVID-19 infection, progression and severity. *Journal of infection and public health*, 2020.
- Ebadi M, Montano-Loza AJ. Perspective: improving vitamin D status in the management of COVID-19. *European Journal of Clinical Nutrition*. 2020; 12:1-4.
- Alyavi AL, Sabirjanova ZT, Tulyaganova DK, Radjabova DI, Nuritdinova SK, Khan T. Relationship between cytokines and the remodeling of the structural and functional state of the left ventricle in patients with coronary artery disease.
- Akanksha Singh, Rita Singh Raghuvanshi. Role of vitamin D in controlling postmenopausal osteoporosis. *International Journal of Chemistry Studies*, Volume 3, Issue 4, 2019, Pages 27-32.