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Clinical correlation of acute phase reactants and vitamin D in patients with coronavirus disease in the north-eastern part of India

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Abstract. COVID-19 is associated with pre-existing co-morbid conditions and vitamin D insufficiency or deficiency as risk factors. Inflammatory biomarkers like acute phase reactants are widely used for monitoring treatment and outcome of the disease. A prospective and observational study was conducted with a purpose to analyse any clinical association of COVID-19 severity with levels of vitamin D, ferritin, lactate dehydrogenase, C-reactive protein, and D-dimer in 100 patients of COVID-19 at a zonal hospital in Tezpur, Assam, India in 2021. All relevant data including age, gender, or co-morbid conditions were retrieved from medical case sheets and laboratory test results. Serum samples of vitamin D and acute phase reactants were collected in COVID wards within 24 hours of admission. Prevalence of 71% of vitamin D deficiency was observed in the current study with mean ±2 SD of vitamin D of 16.6 ± 6.9 ng/mL in Group 1 and 17.1 ± 7.4 ng/mL in Group 2. No significant correlation of COVID-19 with deficiency of vitamin D was observed

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(p = 0.8107). Serum C-reactive protein levels varied substantially between Group 1 (24.46 ± 34.4 mg/L) and Group 2 (38.5 ± 32.5 mg/L) and were significantly associated with disease severity (p = 0.0397). Levels of ferritin, LDH, and D-dimer were also significantly elevated in Group 2 as compared to Group 1 (p < 0.05). It is therefore concluded that low vitamin D levels do not predict severity and outcomes in COVID-19. C-reactive protein, ferritin, lactate dehydrogenase and D-dimer levels are significantly associated and raised in patients with moderate to severe COVID-19

Keywords: COVID-19; observational; C-reactive protein; inflammation; association

Introduction

Coronavirus disease, also known as 2019-nCoV was discovered from Group of people working in seafood market in China who had some unknown pneumonia [1]. The disease swiftly evolved from an epidemic to a pandemic after it spread quickly from China to other parts of the world. As of April 21, 2024, 775,364,261 COVID-19 cases had been confirmed globally, and over 7,046,320 cases of death had been recorded [2].

Many researchers claimed that vitamin D levels can determine severity of COVID-19 infection and its outcomes. S. Singh *et al.* [3] in their cross-sectional study found that COVID-19 is associated with deficiency of vitamin D and older age, presence of diabetes and hypertension as risk factors. D.O. Meltzer *et al.* [4] in their cohort study discovered that deficiency of this vitamin makes people more prone to COVID-19. M. Sobczak & R. Pawliczak [5] in their meta-analysis on the subject found positive effect of vitamin D supplements in decreasing admissions in intensive care units and deaths related to COVID-19 which indirectly supported the aforementioned fact. Some researchers claimed that deficiency of this vitamin is not linked with proneness or negative outcomes of the infection. P. Sanamandra *et al.* [6] in their prospective observational study involving 200 COVID-19 patients concluded that vitamin D deficiency is not linked with severity of infection in Indian population. Similarly, meta- analysis by G. Butler-Laporte *et al.* [7] on 443,734 participants from 11 countries found no correlation between COVID-19 susceptibility, severity, or hospitalisation and vitamin D level. Older age and presence of co-morbid conditions are thought to increase the risk of infection. S. Yastremska *et al.* [8] studied the influence of chronic diseases on COVID-19 manifestation by taking sample of patients from 14 states of United States of America. They found that case fatality rate below 60 years is much lesser (1.5%) than those above 60 years (4.5%) and concluded that chronic diseases are the main risk of life-threatening complications and poor prognosis for patients. It is hence cleared during literature search that difference of opinions among authors exist with regards to vitamin D levels, however all seems to agree with associated severity with older age and presence of co-morbidities.

Variation in the levels of acute phase proteins is bound to happen during the infection and associated inflammatory response. It is known that levels of lactate dehydrogenase (LDH), ferritin, and D-dimers are increased with severity of infection being positive acute phase reactants [9, 10] However, there is a conflicting consensus on C-reactive protein (CRP) level with severity of COVID-19 infections. Meta-analysis conducted by F. Zeng *et al.* [11] on 3,962 COVID-19 patients found that milder form of infection has less elevation in serum CRP. However, a retrospective study conducted by H.C. Luo *et al.* [12] involving 85 patients found no relation of CRP levels with disease severity. Based on above facts, it is observed that there is still a lack of consensus on relation of deficiency of vitamin D and C-reactive protein with the severity of COVID-19 infection. Therefore, it was necessary to conduct a study with the aim of analysing relations of vitamin D levels, acute phase reactants, age group, and comorbidities against the severity of COVID-19 patients. Additionally, the role of COVID vaccination in relation to severity was also investigated.

Materials and Methods

Prospective, cross-sectional, and observational study was undertaken at a zonal hospital in Tezpur, Assam, India, from May to August 2021. Patients who were admitted in the COVID wards during the above period were targeted for the study. Total of 100 patients (22 female, 78 male) were included and divided into 2 groups: Group 1 with mild disease (n = 50) and Group 2 with moderate to severe disease (n = 50) based on the case definition as described below. Moderate and severe cases were put together in Group 2 as there were very few severe COVID-19 patients during the study period. Details of age, gender, and any presence of co-morbid conditions were collected from medical case sheets.

All confirmed cases of COVID-19 diagnosed by RT-PCR test performed on Real-Time PCR Thermal Cyclers by Analytik Jena using Meril COVID-19 RT-PCR kits in a period from 01 May to 31 August 2021. Case definitions for COVID-19 severity were categorised as follows: Mild COVID-19 was characterised by upper respiratory tract symptoms and/or fever without the presence of shortness of breath or hypoxia. Moderate COVID-19 presented with breathlessness, a respiratory rate of 24 or more respirations per minute, and aSpO_2 level ranging from 90 to 93% on room air, accompanied by radiological signs of pneumonia. Severe COVID-19 involved significant breathlessness, a respiratory rate exceeding 30 respirations per minute, and a SpO_2 level below 90% on room air, along with radiological evidence of pneumonia. Chronic debilitating diseases such as chronic obstructive pulmonary diseases, chronic kidney diseases, cancers.

All patients who were newly diagnosed and admitted in the COVID wards were sampled within 24 hours of their admission for all the routine blood tests including CRP and D-dimers as per established protocol by laboratory

technician wearing adequate PPE. Patients were well informed and taken consent for doing additional tests such as vitamin D, LDH, and ferritin for the current study. No special preparation of patients was needed for sample collection. CRP and LDH tests were estimated using a fully automated biochemistry analyser, Dimension EXL-200 manufactured by M/s Siemens healthcare diagnostics (USA). Ferritin, D-dimer, and vitamin D levels were measured using a fully automated immunoassay (Vidas) developed by M/s BioMerieux (France).

Serum samples were refrigerated at 4-5 degrees if these tests were not conducted within 2-3 hours. Reference values differed from one laboratory to another. Values used in the present study are given in Table 1.

Table 1. References values

Serum vitamin D	Serum CRP	Serum D-dimer	Serum Ferritin	LDH
Deficient <20 ng/mL Insufficient <30 ng/mL Sufficient 30-100 ng/mL	Normal <5 mg/L	Normal <500 ng/mL	Males 70-435 ng/mL Females 10-160 ng/mL	Normal 100-190 IU/L

Source: compiled by the authors

An excel worksheet was prepared and data analysed through SPSS software suite. Unpaired t-test and z-test were performed for statistical results. p-value of <0.05 was regarded significant. Data were presented in mean ±SD and in percentages. The prevalence of vitamin D deficiency among patients was assessed using a conventional equation as below:

$$P = X \div N \cdot 100, \quad (1)$$

where P – prevalence of vitamin D deficiency; X – number of patients with vitamin D less than 20 ng/mL; N – total of patients studied.

The study was in compliance with the principles of Declaration of Helsinki [13]. There was no risk or burdens to the patients but would only benefit in understanding the relation of studied parameters in blood in COVID-19 patients. All patients were well informed and given written consent. The study was approved by Hospital Ethics Committee vide application number 155BH/ 01/IEC/2021.

Results

100 confirmed COVID-19 cases were evaluated for their severity and several blood tests were conducted. They were divided into Group 1 with milder severity and Group 2 with moderate to severe COVID-19. 22 (22%) out of the 100 patients were females, whereas 78 (78%) were males. Age ranged from 19 to 71 years however, 82% of patients were under 50 years. 18% of patients were over 50 years with majority (14 cases) belonged to Group 2. Most patients (82%) were under the age of 50. Only one person had all the three co-morbid conditions i.e., obesity, diabetes, and hypertension. Obesity affected 11%, diabetes – 7%, and hypertension – 10% of the study population. During the study, three people succumbed due to complications related to severe COVID-19. Later, it was found that they had one of the co-morbid conditions and were found unvaccinated. 35% of patients received 2 doses of COVID vaccines (Covishield/Covaxin) at the time of admission, 65% had received one dose, and 5% had no history of vaccination. Table 2 summarises the demographic details of patients.

Table 2. Demographic details of patients as per their groups

No.	Parameters	Group 1 (n = 50)	Group 2 (n = 50)
1.	Sex Male Female	 43 7	 35 15
2.	Age <50 years >50 years	 46 4	 36 14
3.	Co-morbid conditions (i) Obesity (ii) Diabetes (iii) Hypertension	 1 1 1	 10 6 9
4.	Vaccination Complete (2 doses) Incomplete (1 dose) Non vaccinated	 28 22 0	 7 38 5
5.	Fatality	0	3

Source: compiled by the authors

Correlation studies were conducted to evaluate any clinical correlation of acute phase reactants, (APRs), deficiency of vitamin D with severity of COVID-19. Prevalence of vitamin D deficiency <20 ng/mL was observed in 71% of all patients (70 and 72% in Group 1 and 2 respectively). Overall, more than 60% of patients had elevated APRs, except for ferritin which showed elevated levels in only 12-19% of patients. The demographic characteristics included in Table 1 were found to differ significantly with respect to disease severity in terms of age, gender, co-morbid conditions, and vaccination status. Younger patients appeared to have a milder form of COVID-19. Co-morbid conditions are less common in Group 1 than in Group 2 patients. Box plot analysis of the parameters for the two groups is also given in Figure 1 (A-F) with p-values.

Mean vitamin D level was 16.6 ± 6.9 ng/mL in Group 1 and 17.1 ± 7.4 ng/mL in Group 2. When data were analysed, no concrete relationship was found regarding severity of COVID-19 infection. Figure 2 demonstrates the percentage of vitamin D deficiency amongst study groups.

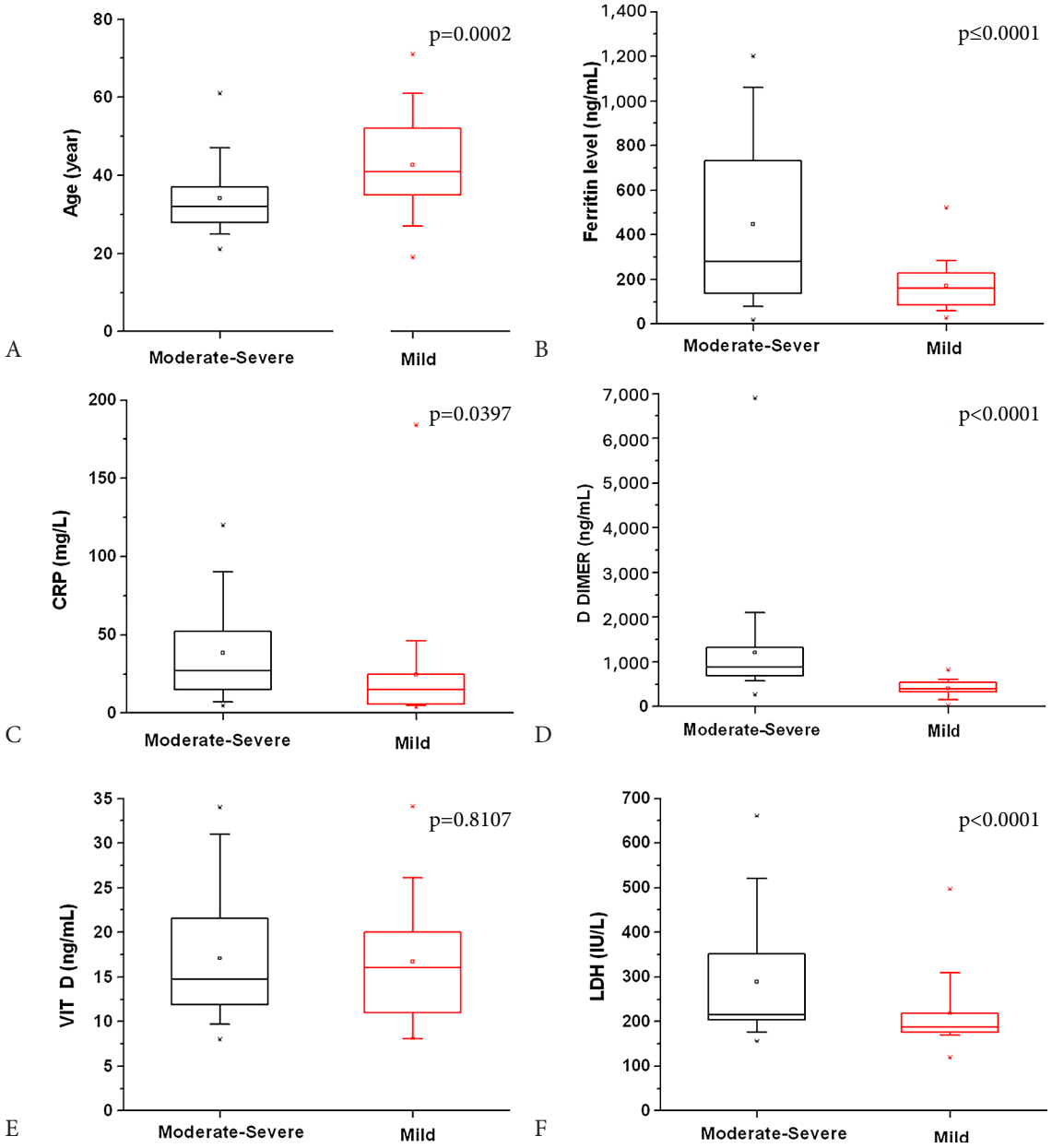

Figure 1. Box plot of the parameters for the two groups (A-F)

Source: compiled by the authors

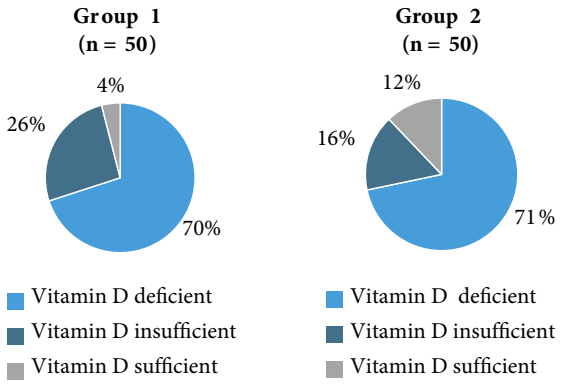

Figure 2. Vitamin D status in Group 1 and Group 2
Source: compiled by the authors

Serum CRP levels also shown significant association between Group 1 (24.46 ± 34.4 mg/L) and Group 2 (38.5 ± 32.5 mg/L), and were linked with COVID-19 severity ($p = 0.0397$). D-dimers, ferritin, and LDH were substantially higher and significant in moderate to severe COVID-19. Group 1 had a mean D-dimer level of 410 ± 171 ng/mL while Group 2 had 1,209 ± 1,050 ng/mL ($p < 0.0001$). Similarly mean ferritin level in Group 1 was 172 ± 111 ng/mL while in Group 2 it was 448 ± 377 ng/mL ($p < 0.001$). Mean level of LDH in Group 1 was 219 ± 82 IU/L while in Group 2 it was 289 ± 136 IU/L ($p = 0.0024$). There was significant finding that patients without proper vaccination had higher risk of moderate to severe COVID-19 infection ($p < 0.0001$). Table 3 summarises analysis of all the above parameters with extent of their significant association with severity of COVID-19.

Table 3. Mean value with standard deviations and range of the studied parameters

Parameters (unit)	Mild (n = 50, male = 43, female = 7)	Moderate/Severe (n = 50, male = 35, female = 15)	p-value
1. Age (years)	34.1 ± 8.8 (21-61)	42.6 ± 12.8 (19-71)	0.0002 (t-test)
2. FERRITIN (ng/mL)	172 ± 111 (27-521)	448 ± 377 (17-1,200)	<0.0001 (t-test)
3. CRP (mg/L)	24.46 ± 34.4 (4-184)	38.5 ± 32.5 (5-120)	0.0397 (t-test)
4. D-dimer (ng/mL)	410 ± 171 (24-823)	1,209 ± 1,050 (270-6,900)	<0.0001 (t-test)
5. Vitamin D (ng/mL)	16.6 ± 6.9 (8.1-34.1)	17.1 ± 7.4 (8-34)	0.8107 (t-test)
6. LDH (IU/L)	219 ± 82 (119-497)	289 ± 136 (156-661)	0.0024 (t-test)
7. Vaccination score (non-vaccinated = 0, incomplete = 1, complete = 2)	1.56 ± 0.50 (1-2)	1.04 ± 0.49 (0-2)	<0.0001 (t-test)
8. Obesity	2%	20%	0.0039 (z-test)
9. Diabetes	2%	12%	0.0510 (z-test)
10. Hypertension	2%	18%	0.0076 (z-test)
11. Survival	100%	94%	-

Source: compiled by the authors

In the current study, overall prevalence of 71% in vitamin D deficiency amongst study participants with mean of 16.6 ± 6.9 and 17.1 ± 7.4 ng/mL were found in Group 1 and Group 2 respectively. In this study age of patients ranged from 19 to 71 years with mean of 34.1 ± 8.8 and 42.6 ± 12.8 years in the Group 1 and Group 2 separately. It was also significantly associated. However, there was no significant relation of COVID-19 severity with deficiency of vitamin D even though there were definite significant association with all acute phase reactants studied. Out of 100 patients only 11% were obese, 7% – diabetic, and 10% – hypertension; hence no significant analysis of co-morbid conditions could be done. 3 patients who died had either one of the co-morbid conditions and were unvaccinated. 35% of patients vaccinated, 65% – partially vaccinated and 5% – had no history of immunisation. Definite positive association was also observed between vaccination and COVID-19 severity.

Discussion

WHO named coronavirus disease 2019 (COVID-19) in February 2020 and declared pandemic on March 11, 2020 [2, 14]. It can spread through droplets, aerosols, and fomites. It can enter the lungs through the nose or mouth, causing respiratory problems. It acts by inhibiting ACE2 function thereby increasing Angiotensin-2 production which causes tissue injury in COVID-19 patients, notably, in the lungs and heart [14, 15]. Cytokine storms is the primary mechanism for injury to these organs [16, 17]. Complications like ARDS, sepsis, and multiorgan failure are major causes of death [18]. Vitamin D exerts its beneficiary effects through reduction of cytokine storms by increasing proinflammatory and decreasing inhibitory cytokines [19]. Several literatures have advocated its role in prevention of infections including COVID-19 by influencing innate & adaptive immunity [20, 21]. Normal level of vitamin D ranges from 30-100 ng/mL. Value of less than 20 ng/mL was considered deficient in this study.

Current study was approached with the initial assumption that deficient vitamin D status is linked with increased severity and complications associated with COVID-19 infection. Clinical complications were more common in moderate to severe infection; however, in the current study no association was found between deficient state of vitamin D and severity or adverse outcome of COVID-19. This corresponds to findings of many authors. B. Thangakunam *et al.* [22] conducted a similar prospective study on 253 patients of COVID-19 but found no significant association of vitamin D deficiency with severity or adverse outcome of the disease. Similarly, present study and meta-analysis by G. Butler-Laporte *et al.* [7] using 2-sample Mendelian randomisation analysis on 443,734 participants from 11 countries also found no correlation of vitamin D level with increased susceptibility, severity, or hospitalisation due to this disease. Furthermore, C.E. Hastie *et al.* [23] on their study on 341,484 patients revealed lack of definite observation to indicate the likely association of deficiency state of vitamin D in COVID-19 patients [23]. Similarly, D. Alkhafaji *et al.* [24] on their study involving 203 COVID-19 patients did not find any relevant association between vitamin D deficiency and COVID-19 severity or outcomes. In their study, they divided patients into three groups unlike two in the current study depending on normal, insufficiency, and deficiency (<20 ng/mL) state of vitamin D. They also used similar level like in the present study to define of vitamin D deficiency.

Finding of the present study that vitamin D level is not associated with COVID-19 severity is not in agreement with many popular beliefs that vitamin D deficiency is linked with severity and outcomes of COVID-19. Many epidemiological studies found an inversely proportional connection between vitamin D deficiency and COVID-19 severity and outcomes. Lower level of vitamin D is believed to be associated with greater risk of developing complications like ARDS, heart failure, and sepsis which are main cause of deaths in COVID-19 [25]. Many researchers like H.K. Biesalski [26] and E. Laird *et al.* [27] also advocated strong relationship between vitamin D deficiency and the severity of COVID-19 disease. In the current study, majority of patients who had moderate to severe infection are above 55 years. This conforms with many researchers like M. Garg *et al.* [28] and P.C. Ilie *et al.* [29], who suggested that age is an independent indicator for severity and mortality rate of COVID-19. However, in present study, two of the patients who died were below 40 years. This indicates that older age is also not a sole criterion which can influence the severity and mortality of the disease.

M.K. Mbata *et al.* [30] also conducted retrospective observational study to look for any association of vitamin D with severity of COVID-19 in 763 patients in 2020 and 2021. Unlike the current study, patients were studied for duration of 30 days but used the same level of defining vitamin D deficiency. Despite having a greater number of patients in mild to moderate severity, they found no relation of vitamin D deficiency with severity of COVID-19. Meta-analysis by J. Chen *et al.* [31] studied 11 cohorts with 536,105 patients and two RCTS, however, they found no association of deficiency of vitamin D (less than 20 ng/mL) with increased risk of COVID-19 infection. They also found that vitamin D supplements did not affect death rates. In a cohort study by Y. Li *et al.* [32] tests for vitamin D were done and analysed in 18,148 patients prior to and during the infection. They found that there was a low level of vitamin D with SARS-CoV-2 seropositivity in unadjusted univariable analysis but found no association when they adjusted potentially confounding factors including age, gender, BMI, etc.

Vitamin D deficiency is one of the global crises that affects people of all ages. Over 1 billion people suffer from vitamin D deficiency. 33 factors contributing to vitamin D deficiency include sedentary lifestyles associated with less exposure to sunlight, older age, obesity, air pollution, dietary factors, etc. In the current study, older patients were observed to have more severity as compared to younger ones. There was 71% overall prevalence of vitamin D deficiency with cut off value less than 20 ng/mL. Many studies based on similar cut off values, for examples, a study conducted by S. Singh *et al.* [3] found prevalence rate of 58.9%, while S. Bennouar *et al.* [34] reported a prevalence of 55.9%. However, there is literature quoting different prevalence rates ranging from 22 to 66% based on different the cut off values used (20-30 ng/mL) [28, 3, 36].

Acute phase reactants (APRs) are useful for COVID-19 treatment and monitoring. There is increase synthesis of plasma proteins called APRs in the body during tissue injury or inflammation. APRs include serum C-reactive protein, erythrocyte sedimentation rate, lactate dehydrogenase, fibrinogen, ferritin, D-dimer etc. In the current study levels of CRP, LDH, ferritin and D-dimer with COVID-19 severity were evaluated and compared.

Normal level of serum C-reactive protein is than 5 mg/L. In this study, C-reactive protein (CRP) levels were significantly different in both groups of patients. Indeed, there was association of CRP levels with severity of disease ($p = 0.0397$) as its levels were found raised, more so Group 2

patients with moderate to severe illness. This finding corresponds to study conducted J.J. Zhang *et al.* [9] who observed that 84% of patients in their study with severe clinical disease had higher CRP levels (more than 150 mg/L). In this study, 86% of patients have raised CRP >5 mg/L, however, only 8 of them crossed over 100 mg/L. Meta-analysis conducted by F. Zeng *et al.* [11] analysing 16 studies and involving 3,962 COVID-19 patients also found that patients with less severity had lower CRP level as compared to severe group. The finding is not supported by H.C. Luo *et al.* [12], who conducted a retrospective study on 85 patients and concluded that CRP levels are not related to disease severity. Similarly, another study by Y. Gao *et al.* [36] also observed no direct relationship of CRP with severity of COVID-19. However, these two studies had smaller number of patients to study.

Necrosis of cell membrane triggers LDH secretion. Its level could help in prediction of COVID-19 severity. In the present study, level of more than 190 IU/L was considered as raised LDH and it was found in 63% of patients. It was substantially higher in Group 2 patients with moderate to severe disease than in Group 1 ($p = 0.0024$). This finding corresponds with the study conducted by J.J. Zhang *et al.* [9] which observed that the increased LDH levels are more commonly associated with increase in severity of COVID-19 infection. They also observed that patients with more than 720 IU/L had severe illness. In the current study only one patient had level more than 720 IU/L.

Ferritin is a protein that stores iron and serves as an inflammatory biomarker. Serum ferritin, a non-specific measure of inflammation, is raised in a variety of diseases. 70-435 ng/mL in males and 10-160 ng/mL in females were considered normal range in this study. Ferritin levels were considerably higher in Group 2 with patients with moderate to severe COVID-19 than Group 1 ($p < 0.0001$). This finding agrees with Z. Lin *et al.* [10], who found that higher ferritin results are related with or could predict higher severity in COVID-19 patients. It was also observed that ferritin level of more than 435 ng/mL were found in 19 males of Group 2 patients; 5 of them had more than 1,000 ng/mL level. Similarly, 12 females from Group 2 had more ferritin levels more than 160 ng/mL; two of them had levels greater than 1,000 ng/mL.

COVID-19 is believed to affect coagulation system in the body. As a result, due to increased fibrinolysis and developing sepsis/DIC in severe infection, levels of D-dimers in blood are raised. D-dimers more than 500 ng/mL (0.5 mg/mL) is considered significant. Its elevated levels could predict early development of sepsis and hence, severity in patient of COVID-19 [38]. In this study, levels of D-dimer were considerably higher in patients in Group 2 as compared to Group 1 with mild severity ($p < 0.0001$). This finding agrees with N. Chen *et al.* [15] who observed that D-dimer and fibrinogen levels are considerably high in severe COVID-19. D-dimer values over 500 ng/mL were found in 62 patients (46 patients from Group 2 and 16 patients from Group 1). 19 of these patients having levels above 1,000 ng/mL.

Lastly in the current study, presence of co-morbid conditions and vaccination status of all patients were also assessed. Obesity was observed in 11%, diabetes – in 7% and hypertension – in 10% of patients. There was significant analysis of co-morbid conditions and severity of disease. Three people succumbed because of severe COVID-19 but all of them had either one of the co-morbid conditions and were unvaccinated. 35% of patients in this study received 2 doses of COVID vaccines (Covishield/Covaxin as authorised by the Govt of India) at the time of admission, 65% had received one dose, and 5% had no history of immunisation. There was an association that patients without proper vaccination had higher chance of going into moderate to severe COVID-19 infection ($p < 0.0001$). This finding corresponds to a study published in BMJ which stated that vaccination against COVID-19 will reduce both severity and long COVID [39]. J. Aslam *et al.* [40] also conducted a study on 1,640 COVID-19 patients and divided them into two groups as vaccinated and non-vaccinated and found that disease progression of COVID-19 into death or mechanical ventilation was significantly low in those patients vaccinated. WHO also advocated its high effectiveness, especially Moderna vaccine against severe form of disease, hospitalisation, and death [41].

Lastly it can be concluded that vitamin D level is not significantly associated with severity of COVID-19. All other parameters like older age, raised CRP, lactate dehydrogenase, ferritin, and D-dimers are significantly associated with severity of COVID-19. Presence of co-morbid conditions and vaccination does affect the severity.

Conclusions

The current study was conducted to analyse whether there were any significant relations of vitamin D levels, acute phase reactants, age, co-morbidities, and vaccination state with COVID-19 infection. At the end of the study, it was observed that vitamin D level was not significantly associated with clinical status of COVID-19, however, as expected, acute phase reactants were found to raise significantly, more with greater severity of disease. Older patients had more severe infection as compared to younger ones. Patients with no vaccination history had an undesirable clinical course in the study with more severe infection. It could be concluded that vitamin D level of a person does not determine their risk of COVID-19 infection. It is also worth mentioning that C-reactive proteins levels will vary depending on the stage of disease. All other parameters like ferritin, lactate dehydrogenase, and D-dimers are significantly raised with increase in severity. Older age and co-morbid conditions and non-vaccination do increase the risk of severe complications. There were some limitations in the study. First, study participants number was modest and as a single-centre study, findings were limited at their generalisability. Second, only patients diagnosed with COVID-19 were included in the study and it would have added more value if a larger scale study was conducted which also

include non-COVID patients and general population. In view of conflicting nature of relation between vitamin D and COVID-19 or any viral infections, it will be worth conducting further research through a larger multi centre approach to confirm this relation.

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Conflict of Interest
None.

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Клінічна кореляція реактивних білків гострої фази та вітаміну D у пацієнтів з коронавірусною хворобою в північно-східній частині Індії

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Анотація. COVID-19 асоціюється з попередніми супутніми захворюваннями та недостатністю або дефіцитом вітаміну D як факторами ризику. Біомаркери запалення, такі як реагенти гострої фази, широко використовуються для моніторингу лікування та результатів захворювання. Проспективне обсерваційне дослідження було проведено з метою аналізу клінічного зв'язку тяжкості перебігу COVID-19 з рівнями вітаміну D, феритину, лактатдегідрогенази, С-реактивного білка та D-димеру у 100 пацієнтів з COVID-19 у зональній лікарні в Тезпурі, штат Ассам, Індія, у 2021 році. Усі відповідні дані, включаючи вік, стать та супутні захворювання, були отримані з медичних карт пацієнтів та результатів лабораторних аналізів. Зразки сироватки крові на вміст вітаміну D та реагентів гострої фази відбиралися у відділеннях COVID протягом 24 годин після госпіталізації. У поточному дослідженні спостерігалася поширеність дефіциту вітаміну D у 71 % із середнім значенням ±2 SD вітаміну D 16,6 ± 6,9 нг/мл у групі 1 та 17,1 ± 7,4 нг/мл у групі 2. Достовірної кореляції між COVID-19 та дефіцитом вітаміну D не спостерігалося ($p = 0,8107$). Рівень С-реактивного білка в сироватці крові суттєво відрізнявся між групою 1 (24,46 ± 34,4 мг/дл) та групою 2 (38,5 ± 32,5 мг/дл) і був достовірно пов'язаний з тяжкістю захворювання ($p = 0,0397$). Рівні феритину, ЛДГ та D-димеру також були достовірно підвищеними у групі 2 порівняно з групою 1 ($p < 0,05$). Таким чином, можна зробити висновок, що низький рівень вітаміну D не прогнозує тяжкість та наслідки COVID-19. Рівні С-реактивного білка, феритину, лактатдегідрогенази та D-димеру суттєво пов'язані та підвищені у пацієнтів з середньотяжким та тяжким перебігом COVID-19

Ключові слова: COVID-19; спостережне; С-реактивний білок; запалення; асоціація