



RESEARCH ARTICLE

Vitamin D Levels in Coronavirus-infected Individuals and its Correlation with Certain Hematological Markers

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ABSTRACT

The world and nearly all our health-care systems were confronted by a significant threat declared by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Determining the SARS-CoV-2 or COVID-19's prognostic and modifiable measures surely would largely contribute to outcome improvement despite the deficiency of causative therapy that affected nearly 200 million people, 3.5 million fatal incidences, and it is still airborne. The research examined probable relations between the levels of vitamin D (VitD) and immunological markers. Hence, a sample of 200 lecturers and students from Cihan University-Erbil were assigned (150 males and 50 females), aged 22–25, with some respondents being treated for a previous COVID-19 infection. The results showed that 98 (or 49%) of the 200 samples had COVID-19 infection. Males 60/98 had a greater prevalence rate (61%), while females 38/98 had a lower rate (39%). According to immunological ELISA results, every patient had positive IgG antibodies and negative IgM antibodies. Compared to the healthy group, the serum levels of IgE rose considerably in COVID-19 patients. However, compared to the healthy group, the serum level of vitamin D3 in the COVID-19-recovered patients showed a considerable reduction. The mean results for hematological parameters indicated a non-significant increase in the number of red blood cells relative to the healthy group but a significant increase in the WBC count, Hb concentration, and platelets. Thus, the result indicates the necessity for interventional studies on vitamin D supplementation in SARS-CoV-2-infected persons by showing a correlation between vitamin D deficit and WBC count during COVID-19 recovery.

Keywords: COVID-19, recovery, Vitamin D, IgE, hematology

INTRODUCTION

Up until the severe acute respiratory syndrome (SARS) outbreak in 2002, coronaviruses (CoV2) were mainly known to cause mild respiratory and gastrointestinal illnesses. However, around that time, they also showed signs of serious pathogenicity in humans and the ability to spread infectiously.^[1]

Scholars^[2] named (3) beta coronaviruses: SARS-CoV-2, Middle East Respiratory Syndrome-Cov, and SARS-CoV2 that prompted to sweeping breakouts causing human fatality rates to amplify the past two decades. SARS-CoV-2 in particular, up to the present time, originated in the killing of nearly 3 million and affected about 130 million citizens.^[3]

According to Rasheed *et al.*^[4] and Habib *et al.*,^[5] the first case was reported from Iraq on February 24th and the first case from Basrah on March 9th. The total number of reported cases is still quite low despite a rise in newly detected cases. It is not clear how many of these situations there are in

reality. The identification of successful cases, which reduced the infection reservoir, social isolation, and personal security measures that disrupted transmission, and the closure of Iraq's borders with other nations – particularly Iran, which may have been the main source of the first COVID-19 cases – are other factors that may have contributed to the reduction in the incidence.^[4] However, the COVID-19 strain that is

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currently causing most cases has entered Iraq and spread throughout the world.^[6]

Determining the exact cause of sickness, be it coronavirus or any other cause, requires a COVID-19 diagnosis. Although there are numerous testing options, an immunological screen test for immunoglobulins is the quickest.^[3]

The benefits and drawbacks of vitamin D supplementation have been widely discussed, with both sides presenting strong cases. The discussion has intensified due to the COVID-19 pandemic.^[4] While vitamin D specialists welcomed the request for additional testing, many in the scientific community expressed worry about the absence of clear standards in light of COVID-19. Numerous experts have determined that taking supplements of vitamin D is generally healthy and that any potential low toxicity will undoubtedly be offset by any prospective benefits regarding the safety of COVID-19.^[7]

The purpose of this study is to look at potential relationships between vitamin D levels and certain blood parameters, such as PCV, WBC, and RBC in patients who have positive COVID-19 immunoglobulin levels.

METHODOLOGY

Blood Samples

From the retrieved cases, a total of 98 aseptic blood samples were taken. Using sterile, disposable syringes, 7 mL of blood were taken from each patient and control group. Blood samples were put into an EDTA tube (2 mL) for hematological parameter testing and a Gel tube (5 mL), which was centrifuged at 2500 rpm for 15 min to collect serum. Each patient's serum was kept in Eppendorf tubes at -20°C until it was needed for ELISA to estimate the levels of IgM and IgG antibodies and Cobas E411 to estimate the levels of IgE and vitamin D3.

IL-10 ELISA Test

The serum sample was thawed and brought to room temperature before the antibodies (IgM and IgG) test was run on each sample using the ELISA assay.

Hematological Tests

Within an hour after sample collection, the complete blood count for each case and control group was determined using the automated Medonic three-parameter coulter.

Immunological Test

Utilizing a fully automated Cobas E411 to ascertain the quantity of each component in serum, the IgE and vitamin D3 tests were carried out.

Statistical Analysis

After statistical evaluation and analysis, the data were arranged in tables. Version 20 of the Statistical Package for the Social Sciences computer application was utilized. Student's t-test was used to compare quantitative variables. If the $P < 0.05$ or 0.01 for the results, they were deemed significant and highly significant, respectively.

RESULTS

Gender of the COVID-19-recovered Patients

Figure 1 represents the percentage of the gender of COVID-19-recovered patients. The number of patients was (98), 38 (39%) were females, and 60 (61%) were males.

Positive and negative cases of IgM and IgG among COVID-19-recovered patients

Results showed that all participants were negative for IgM antibodies and all were positive for IgG antibodies [Table 1].

Mean Serum Levels of IgE among COVID-19-recovered Patients and Healthy Group

Table 2 shows that the mean serum concentration of IgE from COVID-19 patients is highly increased when compared with the healthy control group ($P < 0.1$).

Mean Serum Levels of Vitamin D3 among COVID-19-recovered Patients and Healthy Group

The means of serum vitamin D3 levels in COVID-19-recovered patients were significantly low ($P < 0.01$) when compared to the healthy group [Table 3].

Mean Levels of Hematological Parameters among COVID-19-recovered Patients and Healthy Group

Table 4 shows all means of hematological parameters versus healthy group mean levels. When the mean of total WBC count in COVID-19-recovered patients was compared to the healthy group, it showed a highly significant increase ($P < 0.01$). While the mean level of lymphocyte counts reveals a highly significant decrease when compared to the healthy group ($P < 0.01$), the mean of granulocyte counts of COVID-19-recovered patients presents a non-significant rise in comparison to the mean neutrophil counts of the healthy

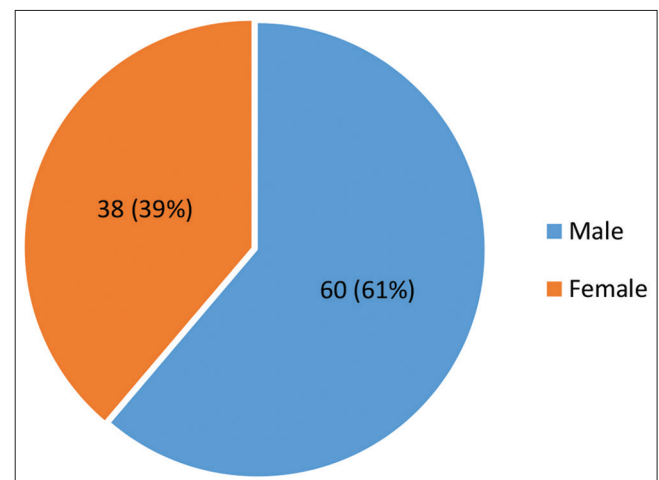


Figure 1: Gender of the COVID-19-recovered patients

group ($P \geq 0.05$). However, the mean counts of monocytes showed a non-significant difference between COVID-19-recovered patients and the healthy group ($P \geq 0.05$).

The mean count of RBC in COVID-19-recovered patients showed a non-significant rise when compared to the healthy group ($P \geq 0.05$).

The mean concentration of Hb reveals a highly significant increase when compared to the healthy group ($P < 0.01$).

Platelet mean count presents a significant rise when compared to the healthy group ($P < 0.05$).

DISCUSSION

From 98 blood samples (60 males and 38 females), the results indicated that 20 were infected with COVID-19. Among patients with COVID-19, the majority of cases were among the male group 60/98 (61%), while in the female group, the prevalence was 38/98 (39%). This may be due to the males in our region are more exposed to people when compared with females who spend most of their time at home with their

families. Another reason may be due to females having more awareness in comparison with the males in sanitation level.

The test results indicated that for IgM antibodies among 98 samples, all of them were negative (100%), while for IgG antibodies, all samples were positive (100%). At the same time, IgE antibody level in the serum of COVID-19-recovered patients is significantly increased compared to the healthy group. Serum vitamin D3 detection among COVID-19-recovered patients revealed that means were highly significantly declined (Mean \pm SE 17.99 \pm 1.34) ($P < 0.01$) when compared to the healthy group (mean \pm SE 30.61 \pm 1.54). Note that there is disagreement over the cut-off vitamin D level for assessing vitamin D sufficiency or deficiency. Given the importance of vitamin D3 for immune system function, many individuals wonder if taking supplements of the vitamin could reduce the risk of contracting the new coronavirus that causes COVID-19. Although there is currently no cure for COVID-19, you can avoid contracting the virus by taking precautionary steps, such as physical isolation and maintaining basic hygiene. In addition, some research indicates that maintaining healthy vitamin D levels will strengthen your immune system and potentially guard against respiratory illnesses in general. A recent study by Maghbooli *et al.*^[8] found that hospitalized COVID-19 patients with adequate vitamin D levels had a decreased risk of adverse outcomes and mortality. The study found that 32.8% of COVID-19 patients at Sina Hospital in Tehran, Iran, had vitamin D insufficiency.

Several of researchers have recently discussed the role that vitamin D plays in preventing COVID-19 or in treating

Table 1: Positive and negative IgM and IgG among COVID-19-recovered patients

| Parameter | No. | Positive cases | Negative cases |
|-------------|-----|----------------|----------------|
| | | (%) | (%) |
| IgM (ng/mL) | 98 | 0 | 100 |
| IgG (ng/mL) | 98 | 100 | 0 |

Table 2: Mean serum levels of IgE among COVID-19-recovered patients in comparison to healthy control group

| Parameter | No. | COVID-19-recovered patients | No. | Healthy Group | t-test P-value | P-value |
|-------------|-----|-----------------------------|-----|------------------|----------------|---------|
| | | Mean \pm SE | | Mean \pm SE | | |
| IgE (ng/mL) | 98 | 142.27 \pm 33.80 | 20 | 30.61 \pm 1.54 | 0.01 | H.S.** |

P: Probability, P value ≥ 0.05 : Non-significant; *P value < 0.05 : Significant; **P < 0.01 : Highly Significant, SE: Stander Error

Table 3: Mean serum levels of vitamin D3 among COVID-19-recovered patients in comparison to the healthy control group

| Parameter | No. | COVID-19-recovered patients | No. | Healthy Group | T-test P-value | P-value |
|--------------------|-----|-----------------------------|-----|------------------|----------------|---------|
| | | Mean \pm SE | | Mean \pm SE | | |
| Vitamin D3 (ng/mL) | 98 | 17.99 \pm 1.34 | 20 | 38.62 \pm 1.47 | 0.01 | H.S.** |

P: Probability; P value ≥ 0.05 : Non-significant; *P value < 0.05 : Significant; **P < 0.01 : Highly Significant, SE: Stander error

Table 4: Mean levels of hematological parameters among COVID-19-recovered patients and healthy group

| Hematological Parameters | COVID-19-recovered patients | | Healthy Group | | T-test P-value | P-value |
|--------------------------------|-----------------------------|-------------------|---------------|-------------------|----------------|---------|
| | No. | Mean \pm SE | No. | Mean \pm SE | | |
| Total WBC $10^3/\mu\text{L}$ | 98 | 6.77 \pm 0.16 | 20 | 6.45 \pm 0.13 | 0.010 | H.S.** |
| Lymphocyte $10^3/\mu\text{L}$ | 98 | 2.04 \pm 0.06 | 20 | 2.85 \pm 0.13 | 0.000 | H.S.** |
| Monocyte $10^3/\mu\text{L}$ | 98 | 0.49 \pm 0.01 | 20 | 0.50 \pm 0.06 | 0.791 | N.S. |
| Granulocyte $10^3/\mu\text{L}$ | 98 | 4.22 \pm 1.08 | 20 | 4.08 \pm 0.14 | 0.491 | N.S. |
| RBC $10^6/\mu\text{L}$ | 98 | 4.99 \pm 0.12 | 20 | 4.05 \pm 0.13 | 0.703 | N.S. |
| Hb g/dL | 98 | 14.66 \pm 0.16 | 20 | 12.95 \pm 0.13 | 0.000 | H.S.** |
| Platelet $10^3/\mu\text{L}$ | 98 | 223.68 \pm 0.30 | 20 | 206.75 \pm 6.90 | 0.048 | S. * |

P: Probability; P value ≥ 0.05 : Non-significant; *P value < 0.05 : Significant; **P < 0.01 : Highly Significant

SARS-CoV2 patients using vitamin D as an intervention. The recommendation is mostly predicated on how vitamin D level affects influenza infectious illness.^[8-11] Other researchers affirmed that the immune system is the first defensive line in our bodies which requires vitamin D to sustain our protection against infection and diseases by increasing immunological response. It retains anti-inflammatory and immunoregulatory effects to trigger the activation to protect.^[8,12,13] While others mentioned, vitamin D has improved immune cell activity and consequently our defensive system, i.e., T-cells and macrophages.^[14-17]

Hematological parameter results showed that the total WBC count among COVID-19-recovered patients was highly significantly increased (mean \pm SE 6.77 ± 0.16) ($P < 0.01$). Furthermore, the mean level of lymphocyte counts reveals a highly significant decrease (mean \pm SE 2.04 ± 0.06) when compared to the healthy group (mean \pm SE 2.85 ± 0.13) ($P < 0.01$). While these results showed the mean monocyte count there was no significant difference between those recovering from Covid-19 Patients and the healthy group ($P \geq 0.05$). The mean count of total RBC counts in COVID-19-recovered patients showed a non-significant rise when compared to the healthy group ($P \geq 0.05$). However, the mean concentration of Hb reveals a highly significant increase (mean \pm SE 14.66 ± 0.16) compared to the healthy group ($P < 0.01$). Finally, the platelet mean counts present a significant rise when compared to the healthy group ($P < 0.05$). A study by Maghbooli et al.^[8] recorded severe leukocytosis (29.2%) in patients, with only one patient presenting with severe leukopenia ($WBC < 2 \times 10^9/L$). It was also mentioned that lymphopenia was featured in 36.9% of patients (absolute lymphocyte count, $0.5-1 \times 10^9/L$), which indicates that our current results are in agreement with Maghbooli et al.^[8] Alteration in the immune response was clear from other studies concerning cytokines in COVID-19 patients.^[17-19]

CONCLUSION

This study showed that most COVID-19-recovered patients were men. ELISA detection for IgM revealed that all samples were negative. At the same time, for IgG, all samples were positive. Vitamin D among recovered patients with COVID-19 has decreased significantly, requiring taking vitamin D supplementation to avoid immune deficiency. All recovered patients have various hematological parameters that revealed a significant increase in total WBC, Hb, and platelets. In contrast, the RBC count had a non-significant rise in comparison with the healthy group. The total means of serum vitamin D3 levels in COVID-19-recovered patients were highly significantly declined when compared to the healthy group.

REFERENCES

1. Z. Song, Y. Xu, L. Bao, L. Zhang, P. Yu, Y. Qu, H. Zhu, W. Zhao, Y. Han and C. Qin. From SARS to MERS, thrusting coronaviruses into the spotlight. *Viruses*, vol. 11, no. 1, p. 59, 2019.
2. C. Drosten, S. Günther, W. Preiser, S. Van der Werf, H. R. Brodt, S. Becker, H. Rabenau, M. Panning, L. Kolesnikova, R. A. Fouchier, A. Berger, A. M. Burguière, J. Cinatl, M. Eickmann, N. Escriou, K. Grywna, S. Kramme, J. C. Manuguerra, S. Müller,... and V. Rickerts. Identification of a novel coronavirus in patients with severe acute respiratory syndrome. *New England Journal of Medicine*, vol. 348, no. 20, pp. 1967-1976, 2003.
3. S. Felsenstein, J. A. Herbert, P. S. McNamara and C. M. Hedrich. COVID-19: Immunology and treatment options. *Clinical Immunology*, vol. 215, p. 108448, 2020.
4. A. M. Rasheed, D. F. Fatak, H. A. Hashim, M. F. Maulood, K. K. Kabah, Y. A. Almusawi and A. S. Abdulmir. The therapeutic effectiveness of convalescent plasma therapy on treating COVID-19 patients residing in respiratory care units in Baghdad, Iraq. *Le Infezioni in Medicina*, vol. 28, pp. 357-366, 2020.
5. O. S. Habib, A. K. AlKanan and N. Q. Mohammed. Epidemiological features of COVID-19 epidemic in Basrah-Southern Iraq-first report. *The Medical Journal of Basrah University*, vol. 38, no. 1, pp. 7-18, 2020.
6. M. A. Ibrahim and A. Al-Najafi. Modeling, control, and prediction of the spread of COVID-19 using compartmental, logistic, and gauss models: A case study in Iraq and Egypt. *Processes*, vol. 8, no. 11, p. 1400, 2020.
7. N. Ali. Role of vitamin D in preventing of COVID-19 infection, progression and severity. *Journal of Infection and Public Health*, vol. 13, no. 10, pp. 1373-1380, 2020.
8. Z. Maghbooli, M. A. Sahraian, M. Ebrahimi, M. Pazoki, S. Kafan, H. M. Tabriz, A. Hadadi, M. Montazeri, M. Nasiri, A. Shirvani and M. F. Holick. Vitamin D sufficiency, a serum 25-hydroxyvitamin D at least 30 ng/mL reduced risk for adverse clinical outcomes in patients with COVID-19 infection. *PLoS One*, vol. 15, no. 9, p. e0239799, 2020.
9. A. Mittal, K. Manjunath, R. K. Ranjan, S. Kaushik, S. Kumar and V. Verma. COVID-19 pandemic: Insights into structure, function, and hACE2 receptor recognition by SARS-CoV-2. *PLoS Pathogens*, vol. 16, no. 8, p. e1008762, 2020.
10. N. Vankadari and J. A. Wilce. Emerging COVID-19 coronavirus: Glycan shield and structure prediction of spike glycoprotein and its interaction with human CD26. *Emerging Microbes and Infections*, vol. 9, no. 1, pp. 601-604, 2020.
11. G. Feketea, V. Vlacha, I. C. Bocsan, E. Vassilopoulou, L. A. Stanciu and M. Zdrenghea. Vitamin D in corona virus disease 2019 (COVID-19) related multisystem inflammatory syndrome in children (MIS-C). *Frontiers in Immunology*, vol. 12, p. 648546, 2021.
12. W. B. Grant, H. Lahore, S. L. McDonnell, C. A. Baggerly, C. B. French, J. L. Aliano and H. P. Bhattoa. Evidence that vitamin D supplementation could reduce risk of influenza and COVID-19 infections and deaths. *Nutrients*, vol. 12, no. 4, p. 988, 2020.
13. T. S. Salih, A. S. M. Juma and M. H. Ubeid. Occupational exposures and associated health effects among dumpsite workers. *Cihan University-Erbil Scientific Journal*, vol. 5, no. 2, pp. 1-5, 2021.
14. J. Cannell, R. Vieth, J. C. Umhau, M. F. Holick, W. B. Grant, S. Madronich, C. F. Garland and E. Giovannucci. Epidemic influenza and vitamin D. *Epidemiology and Infection*, vol. 134, no. 6, pp. 1129-1140, 2006.
15. A. A. Ginde, J. M. Mansbach and C. A. Camargo Jr. Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the Third National health and nutrition examination survey. *Archives of Internal Medicine*, vol. 169, no. 4, pp.384-390, 2009.
16. C. L. Greiller and A. R. Martineau. Modulation of the immune response to respiratory viruses by vitamin D. *Nutrients*, vol. 7, no. 6, pp. 4240-4270, 2015.
17. R. Bouillon, C. Marcocci, G. Carmeliet, D. Bikle, J. H. White, B. Dawson-Hughes, P. Lips, C. F. Munns, M. Lazaretti-Castro, A. Giustina and J. Bilezikian. Skeletal and extraskeletal actions of vitamin D: Current evidence and outstanding questions. *Endocrine Reviews*, vol. 40, no. 4, pp. 1109-1151, 2019.
18. M. H. Ubeid. Interlukin-6 Levels in Relation to COVID-19 Vaccine.

- In: 4th International Conference on Biological and Health Sciences (CIC-BIOHS'2022). Cihan University-Erbil, Iraq, 2022.
19. M. H. Ubeid, T. S. Salih and A. S. M. Juma. HIV, HBS and HCV in dump site workers of Erbil governorate. *Cihan University-Erbil Scientific Journal*, vol. 5, no. 2, pp. 20-23, 2021.
 20. T. Hai, F. A. Alenizi, M. H. Ubeid, V. Goyal, F. M. Alhomayani and A. S. M. Metwally. Using machine learning for comparative optimizing a novel integration of molten carbonate and solid oxide fuel cells with CO₂ recovering and gasification. *International Journal of Hydrogen Energy*, vol. 48, no. 97, pp. 38454-3847, 2023.