

Physiological Disturbances of Vitamin D and some Biochemical Parameters for Coronavirus Patients

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ABSTRACT: This study was aimed to evaluate the concentration of serum vitamin D, potassium, D-dimer, and lactate dehydrogenase (LDH) among coronavirus patients and control healthy individual according to their age ranges. The present study weel-done in AL-Zahra teaching hospital, Wasit province, Iraq; from September 2022 to February, 2023, the role of this study included 80 patients; 40 males (50.00 %) and 40 females (50.00 %) with age range (21-80 year). While, the samples of control groups consist of 60 healthy individuals, 30 males (50.00%) and 30 females (50.00%) with same age of patients group. Both study groups were separated into three age ranges; The 1st age range (21-40) year, 2nd age range (41-60) year, and the 3rd age range (61-80) year, each group of (patients and healthy subject) were separated into two subgroups (male and female).

The present study recorded that the concentrations of serum vitamin D and potassium significantly decreased ($p \leq 0.05$) among (male and female) coronavirus patients as compared with control volunteers in all age ranges. In contrast, serum D-dimer and LDH were elevated significantly ($p \leq 0.05$) among male and female of patient's groups in the 2nd and 3rd age range (41-60 and 61-80) year, while non- significant variation was recorded in the 1st age range (21-40) year in compression to control subject.

Conclusion: Current study concluded that there were clearly significant association between vitamin- D insufficiency and coronavirus susceptibility. Thus, taking a vitamin D supplement can help to reduce the complication of coronavirus infection. Also, significant decreased in serum potassium levels considered as a risk of severe progression of acute cardiac failure among coronavirus patients. While, significant increased in serum D-dimer, and LDH may be associated with increased severity and mortality among coronavirus patients.

Keywords: coronavirus, vitamin D, D-dimer.



1. INTRODUCTION

Coronavirus illness induced by acute respiratory syndrome coronavirus, initially documented in Wuhan, China, in December, 2019. The coronavirus can impact several organs, including the gastrointestinal, liver, heart, neurological, and kidney (1). About (20%) of coronavirus patients experience life threatening consequences, such as hypoxia, respiratory problems, haemodynamic disturbances, and multiorgan inability (2), In these critical instances, there was an elevated demand for special care resources, mechanical breathing apparatus, and extracorporeal oxygenation assistance (3). Vitamin D is a lipophilic vitamin synthesised in the skin. To become active, several

metabolic processes are necessary. These activities take place of in the liver and kidney by (25-hydroxylation), the main end product of this process is 1,25-dihydroxyvitamin-D, which interacts with the vitamin-D receptor (VDR). The predominant effects of vitamin-D are facilitated by (VDR), which present in nearly all nucleated cells (4). The comprehensive impact of vitamin-D has been assessed in several disorders. There is increasing interest in elucidating the function of vitamin-D in the virus immune response, particularly due to its distinct position as a pathogen in contrast to other viral entities that induce respiratory tract disease (5, 6). Hypokalaemia can elevate the risk of acute respiratory infection and cardiac failure, which is regarded as the prevalent problems in coronavirus patients. Severe acute respiratory syndrome- coronavirus (SARS-CoV) bind to angiotensin-converting enzyme 2 (ACE2) and diminishes its expression; as a result, angiotensin-II levels rise, leading to hypokalaemia (7). D-dimer, a fibrin breakdown product and an indirect indicator of thrombotic activity, is well recognised in the risk assessment of venous thromboembolism populations (8). Coronavirus patients exhibit D-dimer levels at arrival that are twice as elevated compared to those with community-acquired pneumonia (9). In critically unwell coronavirus patients, elevated D-dimer levels have consistently been seen (10). Global researchers are striving to comprehend this persistent laboratory pattern and its clinical implications (11). Lactate dehydrogenase (LDH) is an intracellular enzyme present in nearly all organs, facilitating the conversion between pyruvate and lactate, alongside the interconversion of NADH and NAD⁺ (12). Increased LDH levels imply tissue hypoperfusion, reflecting disease severity and potentially influencing prognosis (13). The current study was aimed to assess the concentrations of Vitamin- D, potassium, D-dimer, and lactate dehydrogenase (LDH) in male and female of coronavirus patients and healthy controls volunteers.

2. MATERIALS AND METHODS

2.1 Study design

Subjects for the current study were obtained from patients suffering from coronavirus infection, at AL-Zahra Teaching Hospital, AL-Kut city, Wasit Province, Iraq, during September, 2022 to February, 2023. The current study comprised 80 patients: 40 male (50.00%) and 40 females (50.00%), with an age (21 to 80) year. The control group comprise 60 healthy individuals, consisting of 30 male (50.00%) and 30 females (50.00%), with same age of patients group. Patients and healthy individuals were categorised into three age groups: the 1st group (21-40 years), the 2nd group (41-60 years), and the 3rd group (61-80 years). Each group was further subdivided by gender (male and female).

2.2 Sampling

Five millilitres of venous blood were extracted from coronavirus patients and healthy control subjects using a disposable 5 ml syringe. The blood samples were placed in disposable gel tubes, stand for (30) minutes at room temperature, and centrifuged at (3000) R. per M. for (10) minutes. The serum was then dropped into eppendorf tubes and frozen at (-20) °C.

2.3 Biochemical Analysis

The serum biochemical assay was done by using Cobas 6000 analyzer (Roche- Germany) was used to measure the levels of serum, Vitamin- D, potassium, D-dimer, and lactate dehydrogenase (LDH) depending on kit assay Cobas (roche –Germany).

2.4 Statistical Analysis

Data of the present study were obtained by using (SPSS -25), analysed by one-way ANOVA. The data were express as mean $\pm$ SD (standard deviation). LSD was utilised for comparisons between the coronavirus patients and the control volunteers. P-value of less than (0.05) was deemed statistically significant.

3. RESULTS AND DISCUSSION

Results of the present study indicated that the concentration of serum vitamin D and potassium were decreased significantly ($p \leq 0.05$) among (male and female) coronavirus patients as compared with control volunteers in all age ranges. While, serum vitamin D and potassium exhibit non-significant variation ($P > 0.05$) within all age ranges for both gender of coronavirus patients and control group. (Table 1) & (Table 2).

Table (1): Results of serum Vitamin D (ng/ml) among coronavirus patients and control subject according to age ranges.

Vitamin D (ng/ml)				
Age ranges (years)	Control		Patients	
	male	female	male	female
21-40	35.50 $\pm$ 5.95 Aa	40.00 $\pm$ 4.47 Aa	12.33 $\pm$ 4.58 Ba	14.16 $\pm$ 6.99 Ba
41-60	37.71 $\pm$ 5.67 Aa	36.85 $\pm$ 7.12 Aa	14.00 $\pm$ 5.65 Ba	15.28 $\pm$ 4.71 Ba
61-80	36.71 $\pm$ 8.95 Aa	37.85 $\pm$ 7.40 Aa	12.57 $\pm$ 2.82 Ba	14.00 $\pm$ 3.95 Ba

Data = Mean $\pm$ Standard Deviation

Diverse capital letters in the same row denote to significant differences ($P \leq 0.05$).

Diverse small letters in the same column denote to significant differences ($P \leq 0.05$)

Similar letters refer to non-significant differences ($P > 0.05$).

Table (2): Results of serum potassium (mmol/ L) among coronavirus patients and control subject according to age ranges.

Potassium (mmol/ L)				
Age ranges (years)	Control		Patients	
	male	female	male	female
21-40	3.98 $\pm$ 0.65 Aa	4.33 $\pm$ 0.88 Aa	1.96 $\pm$ 0.64 Ba	1.51 $\pm$ 0.49 Ba
41-60	4.69 $\pm$ 0.98 Aa	4.42 $\pm$ 0.83 Aa	1.91 $\pm$ 0.66 Ba	2.47 $\pm$ 0.87 Ba
61-80	4.35 $\pm$ 0.92 Aa	3.82 $\pm$ 0.70 Aa	1.92 $\pm$ 0.67 Ba	1.94 $\pm$ 0.73 Ba

On the other hand, the present study showed that D-dimer level and serum (LDH) was raised significantly ($p \leq 0.05$) among male and female of coronavirus patients in comparison to control subject in the second and third age range (41-60 and 61-80) year. While, both D-dimer and serum (LDH) concentration exhibit non significant variation ($P > 0.05$) in the 1st age range (21-40) year than in control volunteers. In regarding to age ranges, both D-dimer and serum (LDH) concentration recorded significant increased in the second and third (41-60 and 61-80) age group compared to the first age group (21-40) for both gender of patients group. (Table 3) & (Table 4)

Table (3): Results of serum D-Dimer (ng/ml) among coronavirus patients and control subject according to age ranges.

D-Dimer (ng/ml)				
Age ranges (Years)	Control		Patients	
	male	female	male	female
21-40	164.67 $\pm$ 46.50 Aa	178.17 $\pm$ 12.02 Aa	191.33 $\pm$ 30.46 Aa	181.33 $\pm$ 34.09 Aa
41-60	174.57 $\pm$ 29.14 Aa	182.14 $\pm$ 26.82 Aa	1908.31 $\pm$ 746.91 Bb	3814.20 $\pm$ 5403.92 Bb
61-80	183.87 $\pm$ 22.09 Aa	190.00 $\pm$ 22.71 Aa	1539.42 $\pm$ 606.92 Bb	2347.00 $\pm$ 2664.51 Bb

Table (4): Results of serum LDH (U/L) among coronavirus patients and control subject according to age ranges.

LDH (U/L)				
Age ranges (years)	Control		Patients	
	male	female	male	female
21-40	144.00 $\pm$ 43.93 Aa	156.67 $\pm$ 37.77 Aa	140.00 $\pm$ 46.04 Aa	155.00 $\pm$ 52.05 Aa
41-60	123.86 $\pm$ 48.88 Aa	151.14 $\pm$ 40.77 Aa	301.67 $\pm$ 142.18 Bb	365.71 $\pm$ 105.17 Bb
61-80	149.71 $\pm$ 47.68 Aa	144.86 $\pm$ 42.85 Aa	367.14 $\pm$ 130.60 Bb	342.86 $\pm$ 133.63 Bb

Coronavirus illness is a novel viral ailment that has swiftly disseminated globally. During hospitalisation, certain patients may exhibit severe clinical symptoms that are crucial for recognising illness progression and determining the need for intense therapy. Clinical treatment necessitates a comprehensive patient perspective aimed at meticulous evaluation and targeted blood tests (14). The current investigation indicated clearly decreased in serum vitamin D concentration, aligning with the findings of Kaufman *et al.*, (2020), who reported that severe acute respiratory syndrome coronavirus illness is related with serum vitamin D insufficiency. Consequently, there exists significant relationship between the risk of vitamin- D insufficiency and coronavirus infection including, advanced age, obesity, darker skin pigmentation, Asian ethnicity, and residence in northern latitudes (16). These characteristics correlate with heightened morbidity and death in individuals with coronavirus illness (17). Low serum levels of vitamin D correlate with heightened mortality and severity of coronavirus infection; individuals receiving vitamin D supplementation demonstrate a diminished range of severe infection and a decreased need for intensive care (18). We also observed a substantial decreased in serum potassium levels in coronavirus patients, in line with the findings of Moreno-Pérez *et al.*, (2020), who proposed that the level of potassium serve as a critical biomarker for the development of coronavirus infection. Lippi *et al.*, (2020) found that the risk of coronavirus infection correlates with decreased concentrations of serum sodium, potassium, and calcium. Thus, coronavirus induces hypokalaemia by inhibiting the enzyme angiotensin-converting enzyme 2 (ACE2), which regulates blood pressure through the equilibrium of potassium and sodium levels. This study was found that D-dimer and LDH concentration elevated significantly among coronavirus patients. D-dimer testing is utilised as a diagnostic tool to exclude thrombosis resulting from any mechanism (21). Numerous studies have been recorded that D-dimer levels correlate with the intensity of coronavirus infection (22). Yao *et al.*, proposed that increased D-dimer levels may indicate patients at greater risk of death, hence guiding clinicians in identifying appropriate candidates for intensive care and early intervention (23). Moreover, several investigations have indicated increased LDH levels correlating with the severity of coronavirus infection (24). So, coronavirus induces direct liver infection through viral hepatitis and immunological disturbances involving intrahepatic damage (25). Han *et al.* (2020) indicate a strong link between LDH levels and lung damage. Moreover, myocardial infection and hepatic injuries resulting from COVID-19 are attributed to direct viral damage to the affected organs rather than hypoxia created by lung injury. LDH was discovered to elevate lactate production, resulting in an increase of immunosuppressive cells and a reduction of cytolytic cells, which substantially linked with illness intensity (27).

4. CONCLUSION

Our research underscored the significance of Vitamin D, potassium, D-dimer, and LDH as potential biomarkers in coronavirus patients. The current study revealed that there is a strong link between vitamin D deficiency and susceptibility of coronavirus infection. Consequently, the administration of a vitamin D supplement may mitigate the risk of SARS-CoV infection. Additionally, a substantial fall in blood potassium levels may be regarded as a risk for severe advancement of coronavirus illness. Thus, Significant elevations in serum D-dimer and LDH may correlate with heightened severity and death in coronavirus patients.

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