

## The Presence of D-dimer is an Important Indicator in COVID-19 Infection

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### Abstract

Coronavirus Disease 2019 (COVID-19) is primarily transmitted through respiratory droplets from sneezing and direct contact with infected individuals. COVID-19 mainly affects the respiratory system, particularly the lungs, as well as other body systems such as the circulatory, digestive, and urinary systems. Most patients recover after a period of infection, but some may experience health deterioration, presenting with hematological disorders such as thrombosis (blood clots), which can even lead to death. Therefore, early detection of potential outcomes is very important for clinical diagnosis and patient treatment. D-dimer is a fibrin degradation product; elevated levels indicate the presence of thrombosis and secondary fibrin in the body, making it very useful in diagnosing thrombotic diseases. It has been reported that COVID-19 patients suffer from a hypercoagulable state. The current research aims to highlight D-dimer in COVID-19 infection by presenting its levels in patients. **Materials and Methods** :The cross-sectional study included two groups: 55 patients diagnosed with coronavirus (COVID-19) who attended the outpatient clinic at Imam Hussein City Medical Hospital in Karbala and exhibited moderate symptoms, while the second group consisted of 29 healthy individuals as a control group. The ages of the experimental samples ranged from 18 to 60 years. Blood samples were drawn to perform the required analyses. Several hematological markers were measured, including D-dimer, C-reactive protein (CRP), interleukin-6 (IL-6), white blood cells (WBC), lymphocytes, and blood glucose levels from both groups. Demographic and clinical data were collected from electronic medical records using a standardized data collection form and analyzed statistically using the t-test and analysis of variance (ANOVA) via SPSS software version 20.0. **Results**: The research included 84 samples, of which 55 were infected with the coronavirus compared to 29 individuals as a control group. Several blood parameters were measured, including D-dimer, C-reactive protein (CRP), white blood cells (WBC), lymphocytes, and blood glucose. There are statistically significant differences in the level of D-dimer between the COVID-19 group and the healthy at the  $P < 0.05$  level. It was recorded as ( 2711) ng/ml, while the normal level is always 500, which was recorded in the healthy individuals. A frequency curve representing D-dimer levels between males and females in patients infected with COVID-19, clearly indicating that the number of females is more prominent than males in the research. Also, no significant difference was observed in the level of interleukin 6 between COVID-19 patients and the healthy group, and was observed that there is a significant negative correlation between D-dimer and blood platelets, with an ( $r = -.316$ ) a significance level of  $P < 0.001$ . while, non-significant and negative correlations were found between D-dimer and C-reactive protein and interleukin-6, recorded respectively ( $r = -0.130$ ,  $r = -0.06$ )

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### 1. INTRODUCTION

In the disease caused by the 2019 coronavirus (COVID-19), which is caused by the severe acute respiratory syndrome corona-virus, it not only leads

to shortness of breath but is also associated with an increased incidence of thrombotic events ( Sakka *et al.*, 2020). Cases of thrombosis have been observed, including deep vein thrombosis, pulmonary

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embolism, and microvascular thrombosis in patients suffering from severe COVID-19 (Rostami & Mansouritorghabeh, 2020). These thrombotic complications significantly increase morbidity rates and intensive care admissions among infected individuals (Lippi *et al.*, 2023). Many long-term health complications have been reported in previous coronavirus infection cases. Therefore, the aim of this research was to evaluate D-dimer levels, which are considered the final product of cross-linked fibrin degradation and can be easily measured in the laboratory. It has been previously assessed in cases of disseminated venous thrombosis and primary intravascular blood coagulation, as it is a degradable and soluble product derived from cross-linked fibrin by plasmin (Li *et al.*, 2021). Therefore, the study aims to highlight D-dimer in COVID-19 infection by presenting its levels in patients.

## 2. Meta-analysis and Methods

The cross-sectional study included two groups: 55 patients diagnosed with coronavirus (COVID-19) through the hospital-approved real-time polymerase chain reaction (RT-PCR) test, who visited the outpatient clinic at Imam Hussein City Medical Hospital in Karbala and exhibited moderate disease symptoms, while the second group consisted of 29 healthy individuals as a control group. The ages of the experimental samples ranged from 18 to 60 years and included both genders. After obtaining the necessary approvals to conduct the research in accordance with World Health Organization guidelines, 5 ml of blood was drawn to perform the required analyses. Several biochemical markers were measured, including D-dimer, C-reactive protein (CRP), interleukin-6 (IL-6), in addition to hematological parameters such as white blood cell count (WBC), lymphocytes, and blood glucose from both groups. Exclusion criteria included patients with cancer, pregnancy, chronic liver diseases, malignant hematological tumors, acute coronary syndrome, or those who had undergone surgery or suffered an injury within the past thirty days. Samples were collected from early September 2024 until the end of March 2025. Clinical data, laboratory parameters, and final diagnoses were collected from electronic medical records using a standardized data collection form and analyzed statistically using the t-test and analysis of variance (ANOVA) via SPSS software version 20.0.

## 3. Results

**Table 1.** Biochemical variables between the COVID-19 patient group and the Healthy group

laboratory test	Groups	N	Mean± S. D	p.v
Albumin g/l	Male(19)	55	*2.3±0.41	0.05
	Female(36)	28	4.7.22±1.8	
B.urea mg/d	Male(16)	54	52.94+7.8	.009
	Female(13)	29	21.18+5.6	
D.dimer ng/ml	Male(19)	55	2711.18+38.15	.002
	Female(36)	29	378.52+214.76	
Interleukin-6 (IL-6) pg/mL	Male(16)	55	33.51+3.7	0.11
	Female(13)	29	20.78+2.4	

Albumin ,Interleukin (IL-6), B.urea , D.dimer , Mean±S. D ,P<0.05

It is noted from Table (1) that there are significant differences in the level of D-dimer between the COVID-19 group and the healthy at the 5% level. It was recorded as ( 2711) ng/ml, while the normal level is always 500, which was recorded in the healthy individuals. Also, no significant difference was observed in the level of interleukin 6 between COVID patients and the healthy group, while significant differences were recorded in the serum albumin level among COVID-19 patients, with a reading of 2.3±0.41g/l .

Table 2: Laboratory parameter results				
laboratory test	Groups	Gender	Mean±S.D	P.value
D.dimer n/ml	Patient	Male(19)	2752.38±25	.969
		Female(36)	2678.87±44	
	Healthy	Male(16)	362.63±18	
		Female(13)	395.08±25	
Albumin g/l	Patient	Male(19)	2.32±0.31	0.57
		Female(36)	2.24±0.9	
	Healthy	Male(16)	5.2±1.2	
		Female(13)	4.6±0.9	
B.Glucose mg/dl	Patient	Male(19)	115.6±8.01	0.43
		Female(36)	110.6±9.51	
	Healthy	Male(16)	105.6±6	
		Female(13)	101.6±3.2	
Hemoglobin Hb g/dL	Patient	Male(19)	11.93±1.2	0.41
		Female(36)	13.16±1.9	
	Healthy	Male(16)	13.66±1.6	
		Female(13)	12.56±1.7	
CRP mg/dl	Patient	Male(19)	41.61±6.46	0.14
		Female(36)	75.62±6.79	
	Healthy	Male(16)	19.23±2.16	
		Female(13)	25.37±3.65	
B.urea mg/d	Patient	Male(19)	57.04±8.7	0.36
		Female(36)	55.13±9.14	
	Healthy	Male(16)	23.04±4.76	
		Female(13)	21.13±5.14	
Neutro.%	Patient	Male(19)	0.26±0.40	0.23
		Female(36)	0.23±0.37	
	Healthy	Male(16)	0.04±0.16	
		Female(13)	0.26±0.30	

**Table 2.** Laboratory indicator results between the COVID-19 patient group and the healthy group, and between males and females

Albumin ,Interleuki (IL-6), B.urea , CRP mg/dl, B.Glucose mg/dl, Mean± standard deviation ,P<0.05

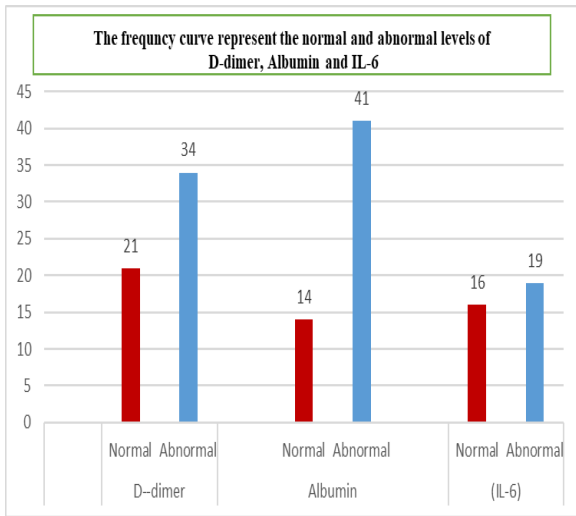
Table (2) shows no significant differences in blood urea levels, serum albumin, and glucose between males and females infected with COVID-19, while significant differences were recorded in the level of C-reactive protein between males and females among the patients, with males having levels of (41.61), (75.62). Also, no significant differences were recorded between males and females regarding the percentage of neutrophils. In general, significant differences are observed in blood hemoglobin between healthy individuals and those infected with COVID-19, with a significant decrease in hemoglobin levels.

**Table 3 :**shows the correlation relationships between D-dimer, CRP, IL-6 and blood platelets.

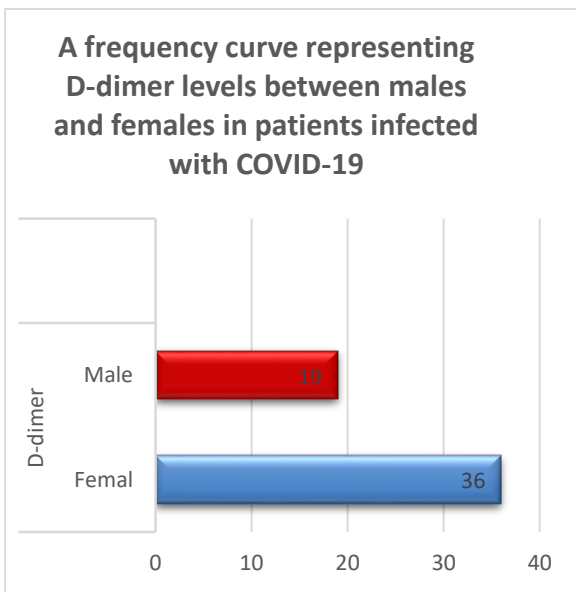
	D.dimer ng/ml	Platelet
D.dimer ng/ml	-	-.316*
CRP mg/dl	-.130	-
IL-6 pg/ml	-.060	-

P<0.05

It was observed that there is a significant negative correlation between D-dimer and blood platelets, with an (r= -.316) a significance level of P<.001. while, non-significant negative correlations were found between D-dimer and C-reactive protein and interleukin-6, recorded respectively(r=-0.130, r=-.060)



**Figure 1:** The frequency curve represent the normal and abnormal levels of D-dimer, Albumin and IL-6



**Figure 2.** A frequency curve representing D-dimer levels between males and females in patients infected with COVID-19.

Figure 1 represents a histogram showing the number of patient and healthy samples and the levels of D-dimer, serum albumin, and interleukin 6. It clearly shows that the values of D-dimer and albumin are more prominent in the blood sample analysis of COVID-19 patients.

In Figure 2, a histogram of D-dimer levels between males and females with COVID-19 is shown, clearly indicating that the number of females is more prominent than males in the research sample.

#### 4.DISCCUTION

The research found that D-dimer levels are higher in females than in males, which may be attributed to physiological reasons or as a result of receiving vaccine doses. This is consistent with many previous studies that indicated a significant increase in D-dimer (Lippi *et al.*, 2021).

COVID-19 can affect blood coagulation through various mechanisms involving both the risk of abnormal bleeding and venous thrombosis. Therefore, all the disorders found can lead to elevated serum D-dimer levels and decreased platelet counts. Furthermore, D-dimer levels are associated with disease severity and are considered a reliable prognostic indicator of hospital mortality in patients infected with COVID-19 (Li *et al.*, 2020).

It was also found that serum CRP concentration and white blood cell count are independently associated with elevated D-dimer levels. Thus, this elevation is believed to be unrelated to symptoms but may result from the presence of venous thrombosis in deep veins associated with infection as a primary cause (Wang *et al.*, 2011).

Regarding inflammatory biomarkers associated with COVID-19 infection, many studies have observed elevated C-reactive protein (CRP) concentrations among patients with severe COVID-19 infection (Dumache *et al.*, 2025). Our study found C-reactive protein levels in COVID-19 patients. White blood cell counts are routinely measured in clinical examinations and are also considered a biomarker of low-grade chronic inflammation.

Interleukin-6 (IL-6) is one of the main cytokines among the cytokines that are excessively produced by activated macrophages. Elevated levels of interleukin-6 have been reported in patients with COVID syndrome and are associated with disease severity. Excessive production of interleukin-6 leads to numerous biological effects that cause damage to target organs, including the differentiation of naive T cells into effector T cells, stimulation of vascular endothelial growth factor (VEGF) expression in epithelial cells, increased vascular permeability, and decreased myocardial contractility (Li *et al.*, 2020).

Some previous studies involving hospitalized COVID-19 patients indicated no association between elevated white blood cell count at admission and disease severity (Lee *et al.*, 2025) (Li *et al.*, 2020). In the current study, which was based on a sample of patients attending the hospital outpatient clinic, a

significant association was found between white blood cell count and elevated D-dimer levels. This result contradicts the findings of Townsend *et al.*,(2020) who found no statistically significant associations between D-dimer and inflammatory markers in treated COVID-19 patients. The reasons for this discrepancy may be related to physiological factors concerning the mechanism of D-dimer degradation or to the hypercoagulable state associated with the cytokine storm, which causes endothelial damage and microvascular thrombosis.

**5.Conclusion:** Our research found that determining the level of D-dimer can be utilized as an important indicator for the presence of COVID-19 infection cases.

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