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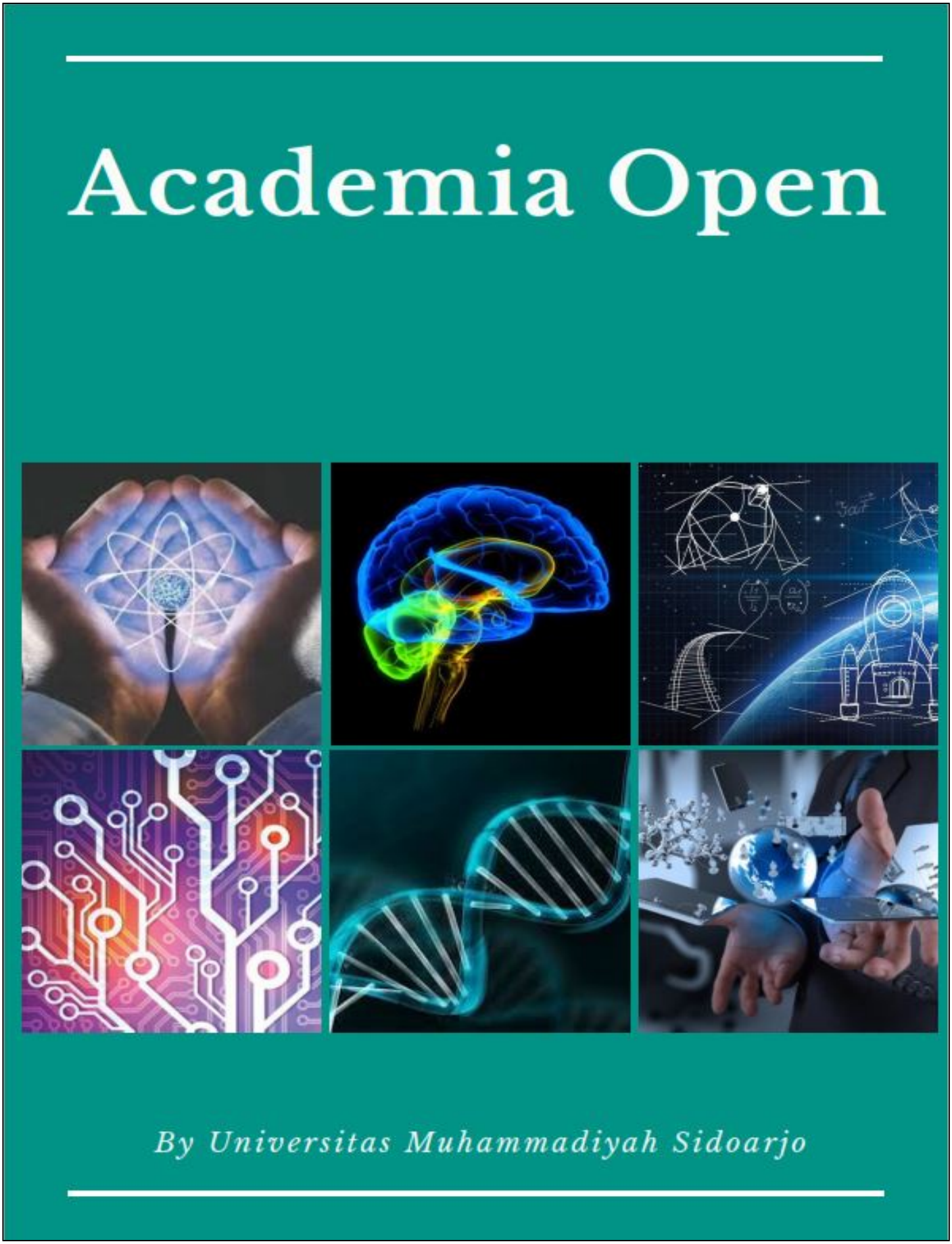

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Association between Relative Risk Factor (RR) and ABO Blood Groups with Clinical Parameters in Patients with SARS-Cov-2

Hubungan antara Faktor Risiko Relatif (RR) dan Golongan Darah ABO dengan Parameter Klinis pada Pasien SARS-Cov-2

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Abstract

This study investigates the correlation between ABO blood groups and SARS-CoV-2 infection among 1,303 participants from Babylon, comprising 397 infected individuals and 906 healthy controls. It explores three primary axes: genetic inheritance of ABO blood groups in 200 families, distribution of these blood groups in the context of SARS-CoV-2 infection, and the relationship of these blood groups with various physiological indicators in infected, recovered, and healthy subjects. The findings reveal that the AB blood group is disproportionately associated with a higher infection rate (RR = 1.808), whereas the O group shows a lesser susceptibility (RR = 0.901). Additionally, physiological changes such as decreased lymphocytes, MCH, and MCHC, alongside increased WBC, CRP, Ferritin, D-dimer, and LDH levels were noted in infected individuals. This study underscores the potential of ABO blood groups as a factor in COVID-19 infection risk, suggesting a direction for future research into tailored medical responses based on genetic predispositions.

Highlights:

- Blood Group Impact: AB group had higher COVID-19 infection rates; O group had lower.
- Physiological Indicators: Infected individuals showed significant changes in key blood parameters.
- Medical Strategy: Findings suggest potential for personalized medical approaches based on ABO blood groups.

Keywords: SARS-Cov-2, ABO Blood Groups, Relative Risk Factor

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Introduction

A highly contagious viral disease, the cause of a global epidemic, (Covid_19) Corona virus disease 19 is Sever Acute and is caused by an emerging strain of corona viruses, and it is called severe acute respiratory syndrome (SARS-Cov-2) based on the evolutionary relationship to the SARS-Cov-2 virus that originated in the year 2003, and this disease was discovered for the first time SARS that caused severe acute respiratory syndrome once during an outbreak in December of 2019 in the Chinese city of Wuhan, and then spread throughout the world, and it is believed that its source is [1], and this virus is a new strain Of coronaviruses is snakes, but many prominent researchers differ in this belief and because this virus is similar to viruses. Bat by 96%, so it is believed to be of bat origin [2].

Since its discovery, more than 268 million cases of the disease and more than 5 million Covid_19 disease have caused deaths around the world, including more than 2 million infections and more than 23 thousand deaths at the level of Iraq. Since its emergence, this disease has caused great loss of life as well as economic losses [3]. Many host-related factors that contribute to the pathogenesis of this disease have been speculated. Blood group, as some studies indicated that blood group [4].

Or SARS-CoV-2 can play a role in the risk of infection with SARS-CoV-2. Compared with individuals with A blood group, individuals with blood group O decrease, while individuals with other blood groups [5] have a chance of contracting the virus. On the other hand, other studies have not been able to show whether the blood group is the cause of infection. Another study, [6] that affects the infection of an individual is related to his blood type [7] concluded that the blood group of individuals has no effect on the risk of contracting the virus. Many changes were observed in blood parameters in corona patients, including changes in the total and differential count of white blood cells, hemoglobin and platelet counts, and an increase in inflammatory indicators such as C-reactive protein and ferritin levels [8], [9].

Methods

A. Study Samples

Blood samples were collected from 1303 individuals, 397 individuals infected with SARS-Cov-2 virus, and 906 healthy individuals, randomly from Babylon Governorate in Iraq, with ages ranging from 20-80 years. The samples were distributed on the following axes:

The first axis: Studying the inheritance of the blood groups ABO in 200 families infected with SARS-Cov-2 virus - and comparing them with healthy subjects.

The second axis: Studying the relationship between ABO blood groups and SARS-Cov-2Corona virus by examining the ABO blood groups and in a sample of 397 infected with Corona virus and 906 healthy individuals.

The third axis: Studying the relationship of ABO blood groups in 100 individuals infected with Coronavirus SARS-Cov-2 and 100 recovered individuals from infection and 100 healthy individuals with some vital indicators, which include a CBC, CRP, Ferritin, Iron factor blood clotting (D-dimer), enzyme lactate dehydrogenase (LDH). 307 of those infected with SARS-CoV-12 were diagnosed by the medical staff at the General Hospital and through laboratory and clinical results and a PCR examination, where the patients with Corona were diagnosed.

B . The ABO Blood Groups are Inherited

Two drops of blood were taken from each sample and placed on a glass slide. The first drop was mixed with anti-A serum and the second with anti-B serum. When coagulation of blood cells for both types of serum occurred, the blood group of the individual was AB. Aggregation of blood cells for both types of serum, so the individual's blood is O. If the aggregation of blood cells occurs in antibody A and does not occur in the antibody serum, then the individual's blood group is B. In the event that agglutination occurs in serum A and does not occur in serum B, the blood group of the individual is A.

ABO Blood Groups	Antigen	Interaction with Antibodies	
		Antiserum A	Antiserum B
AB	A,B	+	+
A	A	+	-
B	B	-	+
O	Null	-	-

Table 1. *The ABO blood groups are inherited*

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1. The Relationship of the ABO Blood Groups to Infection with the Corona Virus

The relationship of the blood groups ABO to infection with SARS-CoV-2 was studied by examining the blood groups using the mentioned method in a sample of people infected with SARS-Cov-2 virus and a sample of healthy subjects, and with the numbers confirmed in the second axis, and the frequency of alleles of the blood groups was calculated ABO in both HIV-infected patients and healthy subjects.

2. The Relationship of the ABO Blood Groups and Some Vital Indicators in Patients with Corona Virus

Samples of venous blood were drawn in an amount of 5 milliliters using a medical centrifugal syringe for each member of the sample mentioned in the third axis. The samples were transferred directly to the laboratory to perform the required tests, which included CBC, CRP, Ferritin, D-dimer and LDH.

a. CRP test

Ten microliters of serum from each individual sample was used after separating it, and the Chroma-1 device was used to perform this test.

b. Ferritin test

Use 30 microliters of serum for each sample and use the Chroma-1 device to perform this test.

c. D-dimer test

For this test, 10 microliters of blood plasma was used for each individual sample, after separating it, and the Chroma- I device was used to perform this test.

d. LDH test

For this test, 10 microliters of blood plasma was used for each individual sample, after separating it, and the Mindary BA-88A device was used to perform this test.

C. Statistical Analysis

The data were analyzed statistically by applying the computer program Minitap Ver 17 by using ANOVA test with Dunkin Test sensory powers test. The polynomial average was compared with probability level 0.05 and 0.01. Chi-square test was also used.

Results and Discussion

A. Relationship of ABO Blood Groups with Corona Virus Infection Covid-19

The Table (1) shows the results of the observed recurrence of the phenotypic patterns of the ABO blood groups of people infected with the emerging corona virus SARS-Cov-2 and healthy subjects, which indicates the presence of significant differences between them ($p<0.001$). The results also indicate a high relative risk factor (RR=1.808) And the increase in the incidence of blood group AB carriers, with a difference of approximately half between those infected with the virus and healthy subjects, compared to other blood groups that did not indicate any increase except for the B blood group, which indicated a slight increase among patients infected with the virus. On the other hand, the current results indicated a decrease in the relative risk factor for patients with blood group O, compared to other blood groups (RR=0.901) This may be due to the low level and activity of the Von Wellebrant Factor in blood group O, or it may be due to the abundance of antibodies in carriers of blood group O [10].

Blood Groups	Patients	Healthy	Relative Risk Factor (RR)	
A	90 (22.67%)	243 (26.82%)	0.913	p<0.001
B	63 (15.87%)	126 (13.90%)	1.141	
AB	46 (11.59%)	56 (6.18%)	1.808	
O	198 (49.87%)	481 (53.10%)	0.901	
Total	397	906		

Table 2. *The observed frequency of the phenotypes of the ABO blood groups of SARS-CoV-2 patients and healthy subjects*

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And when comparing the frequency of the ABO blood groups alleles of healthy subjects and those infected with SARS-Cov-2 virus, while Table (2) shows that there is a high frequency of the IB allele in those infected with the virus, as it reached 0.16 compared to healthy subjects 0.12, It is also noted that the values of the two alleles are equal IA and i Almost all those infected with the virus and healthy subjects.

Groups	Sample Volume	Repeat Alleles of Blood Groups ABO		
		IA	IB	i
Patients	397	0.2	0.16	0.7
Healthy	906	0.19	0.12	0.72

Table 3. *Comparing the frequency of ABO blood groups alleles for SARS-CoV-2 patients and healthy subjects*

The high percentage of blood group AB and allele IB in patients with SARS-CoV-2 is considered as evidence that blood group AB is the most susceptible blood group. It is the most susceptible to infection among Corona patients, and blood group O is the least susceptible to infection, meaning that there is a significant increase in the risk of infection with SARS-CoV-2 virus in patients who have blood group AB and a lower risk for sick individuals who carry group AB [11].

This study also agreed with the study of Zhang et al [8], as it indicated that blood group AB is the most susceptible to infection and that blood group O is the least susceptible to infection in a sample of the Indian population, and this study differed with the first study conducted in China in Wuhan, which is the first place from which SARS-Cov-2 infections began, and it showed that blood group A (37.7%) is the most susceptible to infection, and blood group O is the least susceptible to infection by 25.8%, and that the risk of infection increases with infection, and that blood group O is the least susceptible to infection 25.8%, and that the risk of infection is higher in blood group A and lower in blood group O [12].

This study also differed from the study conducted in New York in the United States of America, which indicated that blood group AB is the least susceptible blood group by 3.5% [13] On the other hand, the study of [14] revealed that blood group A is the most susceptible to infection with SARS-CoV-2, and that deaths were associated with carriers, while deaths decreased among group O carriers. A statistical Arab study conducted on residents of different countries of the Arab world (Iraq, Qatar, Bahrain, Emirates, Kuwait, and Oman) showed that blood group A is the most susceptible to infection, although the population of these countries is common among them blood group O [15]. Another study also confirmed that blood group A is the most affected among the Lebanese [16] From the aforementioned, it is clear from the current study that blood group AB carriers are more at risk of infection with the SARS-Cov-2 coronavirus, and it is possible that the interaction between the SARS-CoV-2 protein and blood antigens, in another way, may contribute to infection with the virus, especially since the virus showed great detail for a group AB blood.

B. The Relationship Between Corona Virus Infection and Some Physiological Indicators

Figure (1) shows the relationship of some physiological indicators to SARS-CoV-2 infection, as it did not notice any significant difference in their values between the recovered and healthy subjects, and when comparing those infected with SARS-Cov-2 virus with healthy subjects, it is noted that there are significant differences for some physiological indicators, which it included WBC, D-dimer, Ferritin, MCHC, MCH, Lymphocyte, LDH, CRP, while it did not indicate any significant differences in the value of PLT, HCT, HGB.

Feng et al [17] indicated an increase in WBC when infected with the SARS-Cov-2 coronavirus, and this is consistent with the results of the current research.

On the contrary, another study showed a decrease in WBC when infected with the SARS-Cov-2 coronavirus [18] and the reason for its decrease may be due to the presence of certain inflammation, which leads to a decrease in its numbers and a decrease in its role in fighting infection and maintaining body health by virtue of its defensive function, i.e. These blood cells are forced to defend the body by virtue of their immune function, so the number of white blood cells decreases [19].

White blood cells and with regard to lymphocytes, the current results indicated a decrease in patients with SARS-Cov-2 virus as well and this is consistent with what was found to him [12]. That the number of lymphocytes decreases significantly in infected people, and this decrease may be an important and useful part in predicting infection with the virus, especially since the numbers of lymphocytes fight the virus, and as a result, their numbers are low.

The current results also showed that there were no significant differences between those infected with the virus and healthy subjects with regard to the HGB index, and this does not agree with what Zhang et al [8] found that there was a decrease in the value of HGB in infected people compared to healthy subjects, and also does not agree with what [20] indicated that the value of HGB increased when the injured. As for the two indicators HCT and PLT

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the results indicated that there were no significant differences between the infected and the healthy, which indicates that there is no relationship between them and SARS-Cov-2 infection, and therefore it is not possible to predict infection with the virus through them.

On the other hand, the values of the MCH and MCHC indices indicate a strong relationship between them and infection with the virus, as it was observed that a severe decrease occurred in their values in those infected with the virus, and this may have a role in the initial diagnosis of infection with the Corona virus.

Groups	WBC $\times 10^3/\mu L$	Lymphocytes %	HGB g/L	HCT L/L	MCH Pg	MCHC g/dL	PLT $\times 10^3/\mu L$
Patients Mean±SD	9.33±2.20[a]	20.35±4.20[b]	12.51±2.17[a]	39.90±6.30[a]	26.59±4.32[b]	30.05±3.11[b]	224.6±19.09[a]
Recovered Mean±SD	7.43±2.33[b]	30.10±6.69[a]	12.64±2.14[a]	41.01±6.24[a]	29.92±2.75[a]	33.43±2.32[a]	240.16±19.70[a]
Healthy Mean±SD	7.75±2.46[b]	31.13±6.33[a]	12.61±1.86[a]	39.23±5.19[a]	29.66±3.81[a]	34.61±4.11[a]	223.38±17.64[a]
p-value	0.052	0.0008	0.905	0.124	0.0008	0.001	0.0308

The different letters indicate the existence of significant differences.

Figure 1. *The relationship of CBC with SARS-Cov-2 infection in patients, recovered and healthy groups*

C. The Different Letters Indicate the Existence of Significant Differences

The value of CRP was 72.70±17.54 mg/L in patients infected with coronavirus compared to healthy subjects, as its value was 3.68±2.29 mg/L. This difference in the indicator values can be used as a prediction of infection with the virus, and this is consistent with the findings [18] found an increase in its levels in those infected with the virus. Corona compared to healthy subjects.

As for ferritin, the results of this study showed that high levels of it are related to the severity of the disease, and this was confirmed by a previous study that ferritin secretion increases in infected people. And D-dimer values rise in people infected with the coronavirus, and this is due to the occurrence of blood clots or acute pulmonary embolisms that prevent sufficient oxygen from reaching the body. The lung, as demonstrated by the findings of [21], as he indicated that it can be considered an indicator of infection prediction, and its high increases the incidence of mortality, and finally, the high values of LDH in people with coronavirus, as is the case in the current study, may be attributed to an increase in its secretion. As a result of the occurrence of acute inflammation in the body in people infected with the virus, and this is consistent with what was mentioned by another study, where it considered the rise in LDH to be a sufficient indicator of infection with the virus, and that the increase of this enzyme much more than the normal limit exposes the person infected with the virus to the risk of death.

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Groups	CRP mg/L	Ferretin ng/mL	D-dimer µg/L	LDH U/L
Patients Mean ±SD	72.70±17.54[a]	254.40±20.30[a]	1028±47[a]	384.30±21.60[a]
Recovered Mean ±SD	3.83±1.97[b]	127.79±12.81[b]	177.40±24.50[b]	113.34±19.85[b]
Healthy Mean±SD	3.68±2.29[b]	100.44±13.44[b]	147.40±27.50[b]	103.44±12.03[b]
p-value	0.0009	0.0009	0.0007	0.00004

Figure 2. *The relationship of CRP, Ferretin, D-dimer, LDH, with SARS-Cov-2 infection in patients, recovered and healthy groups*

When distributing indicators according to ABO blood groups and comparing them between patients, healthy and recovered in Figure (3), noted that there is no significant difference in their values between the recovered and healthy subjects for all physiological indicators. Lymphocyte, MCH, and MCHC indicators decreased in SARS-Cov-2 infected patients compared to healthy subjects, while WBC, Ferritin, LDH, CRP, and D-dimer indicators significantly increased in SARS-Cov-2 infected patients compared to healthy subjects.

A discrepancy was observed between the values of the physiological indicators between the ABO blood groups in patients infected with the virus, as the highest value of the CRP index was 95.20±12.2 mg/L in patients with blood group B, while the lowest value was 55.00±12.2 mg/L in those with blood group O, as was the highest value for the index Ferritin 280.30±22.3 ng/mL in patients with blood group A and the lowest value in patients with blood group B (229.40±14.6 ng/mL). The highest D-dimer value was recorded in O blood group carriers 1342±24.1 µg/L. It is less valuable for carriers of A blood group (767±50.2 µg/L). As for the LDH index, it recorded its highest value for group B holders (432.70±25.2 U/L) and it is less valuable for those with blood group AB (319.90±21.3 U/L). In those infected with the virus, while the average WBC value was recorded in the blood group O, 8.37±3 (×103/ µL) .

And the highest value for blood group A carriers is 9.99±1.6 (×103/µL) in those infected with the virus. The highest value of the Lymphocyte index was 21.65±3.2% for those with blood group AB and the lowest was 19.21±3.2% for those with blood group O.

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Groups	ABO blood	WBC $\times 10^3/\mu L$	Lymphocyte %	HGB g/L	HCT L/L	MCH Pg	MCHC g/dL	PLT $\times 10^3/\mu L$	CRP mg/L	Ferretin ng/mL	D-Dimer µg/L	L D H U/L
Patients	A	9.99±1.6^a	19.51±2.2^b	12.15±3.2^a	39.03±9.3^a	26.95±5.9^b	29.15±4.3^b	231.10 ±21.3^a	82.20±15^a	280.30±2 2.3^a	767±50 .2^c	389.10 ±19.6^b
	B	8.64±2.2^a	21.10±2^b	12.47±8^a	40.44±15.2^a	26.05±3.3^b	30.14±6.6^b	229.20 ±19.7^a	95.20±12 .2^a	229.40±1 4.6^b	1137±4 9^b	432.70 ±25.2^a
	AB	8.53±3.3^a	21.65±3.2^b	11.77±2.2^a	37.50±12^a	26.04±15.1^b	30.04±10^b	279.30 ±20.3^a	57.80±15^b	271.00±2 3.1^a	351±35 .23^d	319.90 ±21.3^d
	O	8.37±3^a	19.21±3.2^b	12.02±4.2^a	40.86±11.2^a	26.50±5.6^b	30.85±3.6^b	204.20 ±19.9^a	55.00±12 .3^b	242.90±1 9.6^b	1342±2 4.1^a	359.30 ±23.2^c
Recovered	A	7.75±0.52^a	30.43±1.02^a	12.63±3.5^a	41.06±9.6^a	29.72±11^a	32.97±9.3^a	253.60 ±20.1^a	3.24±2^c	123.00±1 6.3^c	152.30 ±15.6^c	126.30 ±12.3^c
	B	7.25±1.5^a	28.65±2.5^a	13.06±4^a	42.28±9.3^a	29.65±9.2^a	33.05±9.6^a	225.20 ±19.6^a	3.92±1.3^c	116.60±1 0.2^c	186.80 ±12.32^c	96.80± 13.2^c
	AB	6.81±1.4^a	28.42±3.6^a	11.98±2.5^a	38.17±8^a	30.08±11.02^a	32.83±10.2^a	218.70 ±14.6^a	3.36±2^c	97.00±9. 6^c	220.20 ±25.2^c	107.70 ±15.3^c
	O	7.30±1.9^a	30.98±4.2^a	12.51±4^a	40.77±7.5^a	30.23±12.5^a	34.18±11^a	238.30 ±19.5^a	4.45±1.0 5^c	143.60±1 2.2^c	190.60 ±20.01^c	110.10 ±9.1^c
Healthy	A	7.00±3.1^a	32.15±3.1^a	12.63±4^a	39.99±6.3^a	28.18±12.01^a	33.57±12^a	226.70 ±29.8^a	3.11±0.0 3^c	112.60±1 5.5^d	148.10 ±15.36^c	109.20 ±10^c
	B	9.40±2.5^a	29.72±2.3^a	12.05±3.4^a	38.30±10.2^a	30.65±11.2^a	33.65±11.2^a	227.80 ±16.6^a	3.64±1.3^c	83.20±12^c	165.80 ±17.5^c	99.20± 7.5^c
	AB	7.12±2^a	28.25±2.3^a	12.76±1.5^a	39.13±11^a	30.48±12.1^a	33.60±10.2^a	223.50 ±20.21^a	5.61±2.3^c	83.50±10 .1^c	150.10 ±19.6^c	123.30 ±10.2^c
	O	7.46±1.52^a	29.66±1.55^a	12.83±2.5^a	39.31±9.9^a	29.77±19.6^a	33.30±14.3^a	219.70 ±23.6^a	3.64±1.0 5^c	105.00±1 2.2^c	149.80 ±23.1^c	99.80± 12.2^c
P-value		0.333	0.0003	0.709	0.541	0.0003	0.0003	0.575	0.0005	0.0004	0.0003	0.0008

Figure 3. *The relationship of SARS-Cov-2 infection with physiological indicators according to the ABO blood groups*

Conclusions

There is a relationship between ABO blood groups and SARS-Cov-2, as AB blood group carriers are more likely to be infected with the virus, and O blood group carriers are less likely to be infected. An increase in the physiological indicators of each of the LDH, D-dimer, Ferritin, CRP, WBC And a decrease in the physiological indicators of each of the MCHC, MCH and lymphocytes in people with coronavirus.

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