Relation between the ABO Blood Group and the Corona virus Disease (COVID-19)

Distribution Recovery and Death in AL-Bayda City, Libya

by

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ABSTRACT

Introduction: ABO blood group systems are related to many diseases, including bacterial and viral diseases and cancer. **Objectives** The relationship between ABO blood group and the incidence of coronavirus disease (COVID-19) infection and death has been examined in several studies**.:** we aimed to compare the blood group distribution of patients with COVID-19 infection and percent of recovery and death **Method:** this study was conducted on data collected from families or patients who were infected by COVID-19 in the period from August 2020 to January 2021, with a total of 300 subjects. **Results:** A total of 300 COVID -19 cases, 261 has recovered and 39 died, the age group of 60 had the highest percent of deaths ,with males outnumbering females , we found that The pooled frequency of blood groups O^+ ,O^- ,A^+ . B^+ A^- ,B^- ,AB^+ and AB^-, among COVID-19–infected individuals was estimated as (17.7%),(12.3%),(27.0%),(9.0%),(15.3%),(2.7%),(10.7%),(5.3%) respectively. The frequency of blood groups O^+ ,O^- ,A^+ . B^+ A^- ,B^- ,AB^+ and AB^- among patients who died of COVID-19 infection was estimated as(30.8%),(30.8%),(5.1%),(7.7%),(2.6%),(0.0%),(23.1) and ,(0.0%) respectively. Association analysis between the ABO blood group and COVID-19 indicated that there was a statistically significant difference for blood groups O^+ ,O^- ,A^+B^+, and AB^- (P=0.001),(P=0.021) ,(P=0.001),(P = 0.001) and (P=0.007)respectively but not for blood groups A^- ,B^- , and AB^+(P=0.156),(P=0.132) and (P=0.268) respectively. **Conclusion:** it is important to focus on the high –risk groups for severe infection and death, Our findings provide epidemiological evidence that blood group A^+ and O^+ were susceptible to COVID-19 However, these research results need to be confirmed in future studies.

Keywords: *Blood group, coronavirus, COVID-19, recovery, death*

Introduction

CORONA disease is considered as a serious public health event, it was first observed in Wuhan in December 2019 and suddenly spread throughout the country then to the world. The cause of COVID-19 is a new member of the corona virus family which is known as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) [1].
There are several risk factors that make people more likely to develop severe COVID-19, including hypertension, diabetes, being obese, asthma and cardiovascular disease

SARSCoV attaches to the human angiotensin-converting enzyme2 (ACE2) receptor with the spike protein and infects cells[2].
Age and sex are considered as a risk factor in susceptibility to COVID-19 which is suggested by recent clinical study, as older people and men are more susceptible to infection[3].

The symptoms differ with some people experiencing only mild symptoms and others being hospitalized and requiring ventilation [4] .
According to recent epidemiological studies, the incubation period is 1-14 days with an average 3-7 days, although in some cases it can last up to 14 days[5,6].
Infection can be transmitted during the incubation period, and asymptomatic infection may also become the cause of spreading the infection. The major route of infection are respiratory droplets and close contact. The main symptoms are fever, fatigue, and dry cough. Acute respiratory distress syndrome, septic shock, and even death in severe cases [7,8]. many articles reported the relationship between the ABO blood group and COVID-19,they found the same results that individuals with group A have a higher risk of becoming infected than individuals group O.As SARS-CoV-2 is a totally new virus, the effect of blood groups susceptible to COVID-19 is unclear. These include papers by Zhao *et al*., Zietz *et al*., Zeng *et al*. Li *et al*. and Wu *et al*., all these Studies have been shown that antigens of blood group found in erythrocytes and other tissues interact with microorganisms such as bacteria, viruses, parasites, and fungi. Differences in blood group antigen expression may increase or decrease host susceptibility to many infections [3,9,10,11,12].

This can play a direct role in infection by acting as a receptor and/ or co-receptor for blood group antigens, microorganisms, parasites, and viruses.
ABO antibodies are the major part of the innate immune system against some bacterial pathogens and enveloped viruses carrying ABO-active antigens there are some of the infectious agents which have been shown to be related to human blood group such as *Helicobacter pylori*, *Vibrio cholera*, hepatitis C virus, human immunodeficiency virus, and SARS [13].
As people with blood group O had more affinity to infected with Norwalk virus and Helicobacter pylori infection, although they had less affinity for SARS. There is another study which confirmed that blood group A was related to an increased risk of acute respiratory distress syndrome in trauma and sepsis patients.
Studies have shown that the rate of death along with people who were infected by COVID-19 was reported in terms of different blood groups.
Meta-analysis of studies showed no significant association between mortality and different blood groups in COVID-19patients. However, prevalence of death due to COVID-19 was significantly lower in blood group O compared to other
Blood groups [14].

All these studies were not confirmed, as every day there are new facts of how corona virus invades our body. Consequently, the aim of the study is to investigate the relationship between the ABO groups andCOVID-19 (susceptibility and severity) in AL-Bayda city and further classified the populations according to gender and age.

METHOD

The study was performed by collecting data from families or patients who were infected by COVID-19(as blood group not found in the patient's file in the hospital), in the period from August 2020 to January 2021, with a total of 300 subjects.
The main data which were collected are age, gender and blood group. All information was obtained and analyzed by using statistical package social SPSS version26 by logistic analysis .P values of less than 0.05 are considered to be statistically significant, and it was performed with respect to the main study aim.

Results:

Table 1: The demographic of the total subject (sample =300)

The present research consisted of 300 participants, of whom 141 were males and 159 were females. The age range of patients was < = 40 was (25.3%), 41-05 was (25.0%), 51-66 was (25.7%), > 67 was (24.0%). The frequencies of blood types O^+ O^- were 17.7% 12.3%respectively ,A^+ B^+ were 27.0% 15.3%,A^- B^- were 9.0% 2.7 % and AB^+ AB^- were 10.7% 5.3% respectively.

Table 1 shows the demography of the total subject

Parameter	Total subject
Number of participants	300
Age in year <= 40 41—50 51 – 66 >67	 (25.3%) 76 (25.0%) 75 (25.7%) 77 (24.0%) 72
Gender Male Female	 (47.0%)141 (53.0%)159
Blood T O^+ O^- A^+ B^+ A^- B^- AB^+ AB^-	 (17.7%) 53 (12.3%) 37 (27.0%) 81 (15.3%) 46 (9.0%) 27 (2.7%) 8 (10.7%) 32 (5.3%) 16

Table 2: Distribution of recovery and death by COVID-19 according to age.

The highest percent of recovery was (28.7%) in age < = 40 and the highest percent of death was (64.1%) in age > =67.

Table 2: Distribution of recovery and death by COVID-19 according to age.

Age	Recovery	Death
< =40	(28.7%) 75	(2.6%) 1
41-50	(28.0%) 73	(5.1) 2
51-66	(25.3%) 66	(28.2%) 11
> = 67	(18.0%) 47	(64.1%) 25

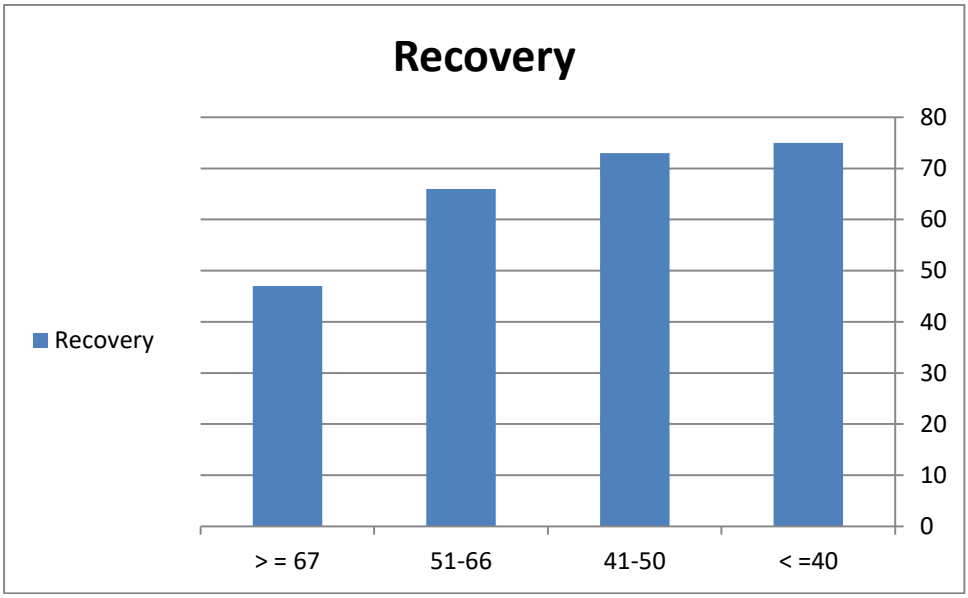

Figure 1: Distribution of recovery by COVID-19 according to age

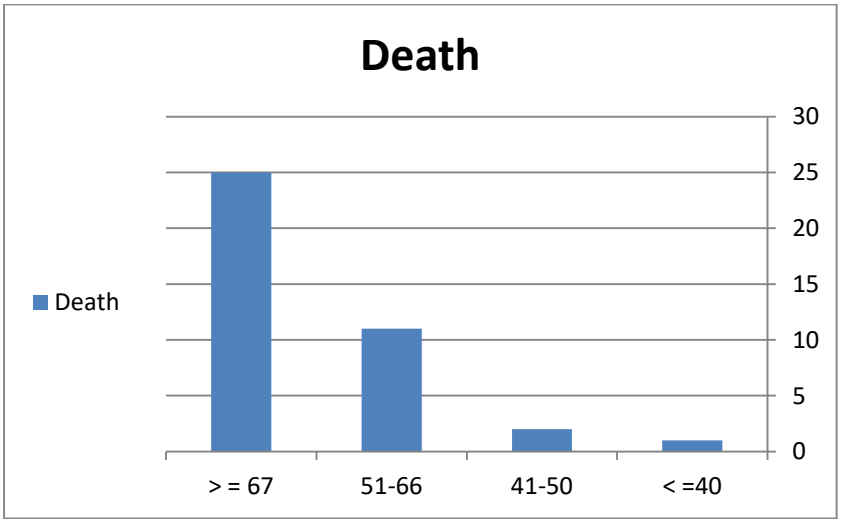

Figure2: **Distribution of death by COVID-19 according to age**

Table 3: Distribution of recovery and death by COVID-19 according to gender.

According to the results shown in **table 3** we found that Females were more susceptible to COVID-19 infection where the high percentage of death was in male .

Table 3: Distribution of recovery and death by COVID-19 according to gender.

Gender	Recovery	Death
Male	(45.6%) 119	(56.4%) 22
Female	(54.4 %) 142	(43.6%) 17

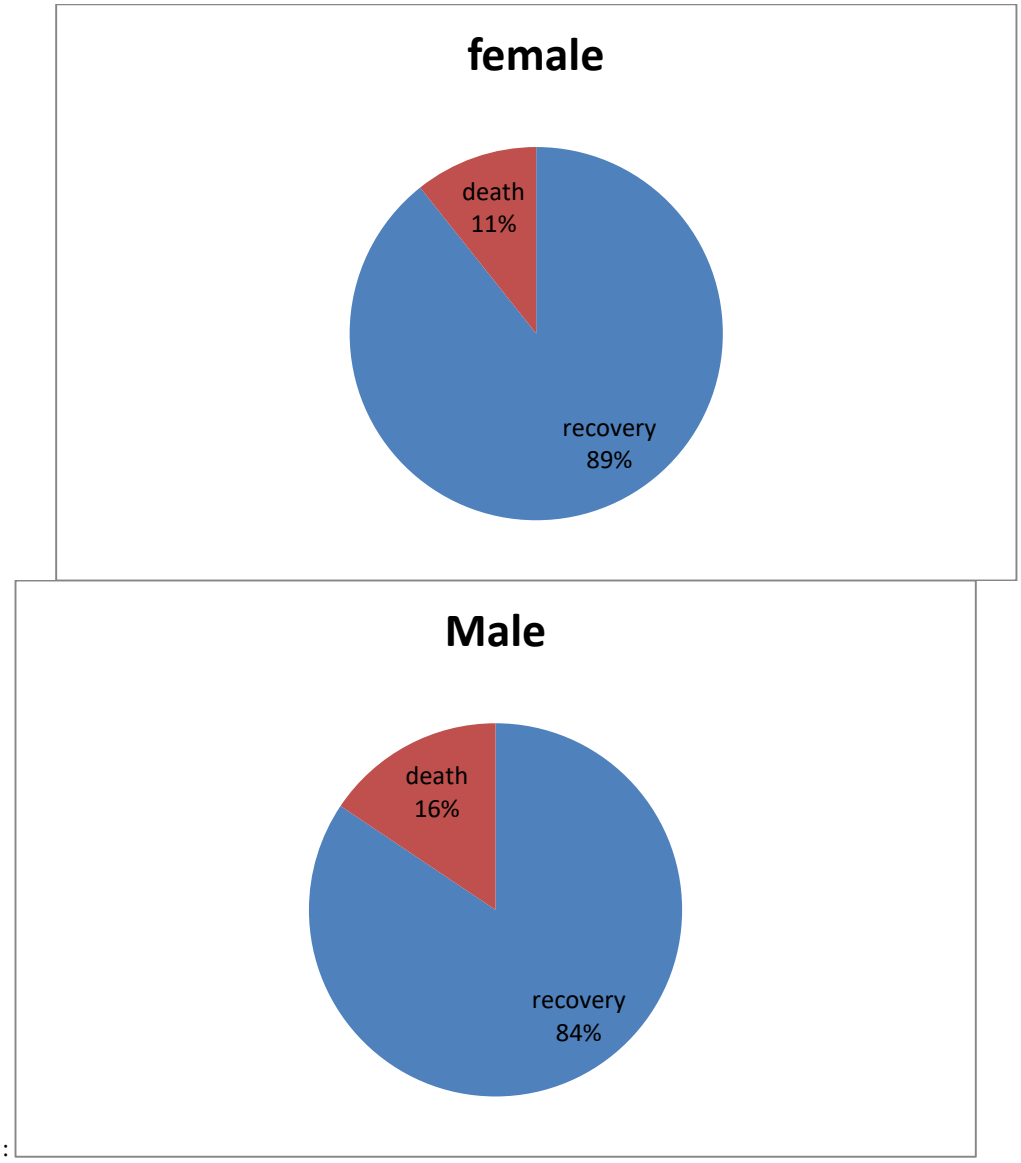

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Figure 3: Distribution of recovery and death by COVID-19 according to gender.

The distribution of blood groups and the susceptibility to COVID-19 infection , we found the highest percent which was (27.0 %) for blood group A^+ , (17.7%) was O^+ , (15.3%) for B^+ , (12.3%)for O^- ,(10.7%) for AB^+ ,(9.0%) for A^- ,(5.3%)for AB^- and (2.7%) for B^- .

In the logistic regression analysis which was used to adjust the association between the ABO blood group and COVID19 recovery and death, it is found that a statistically significant difference for blood groups O^+ ,O^- ,A^+ . B^+, and AB^- (P=0.001),(P=0.021) ,(P=0.001),(P = 0.001) and (P=0.007)respectively, but not for blood groups A^- ,B^- , and AB^+(P=0.156),(P=0.132) and (P=0.268) respectively. These data indicate that the blood group of COVID-19 infected patients is a potent factor that influences the development and outcome of COVID-19 when the age of patients is 51-66 as shown in **table 4 .**

Table 4: the relation between blood groups and recovery or death by covid19

Blood T	RECOVERY	DEATH	*P*-Value
O^+	**(15.7%) 41**	**(30.8%)12**	**0.001**
O^-	**(9.6%) 25**	**(30.8%) 12**	**0.021**
A^+	**(30.3%) 79**	**(5.1%) 2**	**0.001**
B^+	**(16.5%) 43**	**(7.7%) 3**	0**.0010**
A^-	**(10.0%) 26**	**(2.6%) 1**	0**.1560**
B^-	**(3.1%) 8**	**(0.0%) 0**	0**.1320**
AB^+	**(8.8%) 23**	**(23.1%) 9**	0**.2680**
AB^-	**(6.1%) 16**	**(0.0%) 0**	0**.0070**

Discussion In this present study, females were infected more than males, but the highest percent of death was in male by (56.4%), this effect may be related to different anatomical structures, Estrogen levels ,immune systems and genetic backgrounds of men and women.

The Age group which was more affected (51-66) and the age group with the highest percent of death were > =67, that means the older people are more affected by COVID-19.

A study in the Netherlands revealed that higher age is the main determinant of COVID-19 related in –hospital mortality .whereas pre-existing comorbidities (including hypertension, diabetes mellitus, dyslipidemia, chronic kidney disease, chronic obstructive pulmonary disease and cardiac disease) are more prevalent in the elderly, their mediation effect on COVID-19 related in –hospital mortality is minimal [15].

In this study the most affected blood group was A+ by (27.0%) , as demonstrated by a study which was done by Qian Fan et al in Wuhan 2020(1),but the highest percent of deaths was in blood group (O) by (30.8%).

Hakan GoKER et al, 2020[16] demonstrated that blood group A was more frequent and blood group O was less frequent in COVID-19 patients.

Some studies demonstrated that the blood groups did not have significant predictive effects on the need for intubation, need for ICU hospitalization and mortality; and that the most significant factors affecting the clinical outcomes were age and the history of

co morbidity. Few studies were evaluated in blood groups in terms of the needs for intubation, ICU hospitalization and clinical outcomes.[3]

In a previous study, conducted with 42 healthcare professionals in Hong Kong during the SARS epidemic period, it was presented that those with blood group O had a lower incidence of SARS- CoV infection than the non-O (OR, 0.18; 95% confidence interval, 0.04–0.81). The patients with blood group B also demonstrated a tendency to the disease; however, there was no statistical significance (OR: 1.46). In an animal model, which was carried out to present the mechanism of this result, it was found that the anti-A antibodies found in individuals with blood group O inhibited the interaction of SARS-CoV-1 virus S spike protein and the ACE-2 receptor [17].

A number of studies have been carried out on this subject since the beginning of the SARS-CoV-2 pandemic. First of all, in a study on 265 COVID-19 patients, it was presented that the blood group O was less frequent in severe COVID -19 patients who required long hospitalization ($P < 0.01$), and the blood group A was more frequent in patients with severe COVID-19 infections compared to the normal population (0.017) .Two different studies have also demonstrated the possible protective effect of the blood group O [9]

In comparison between two studies, the first with COVID-19 in Canada and the second was for SARS-CoV-2 showed an increase risk of COVID-19 and SARS-CoV-2 in patients with blood group A or AB and requiring mechanical ventilation, continuous renal replacement therapy and prolonged intensive care unit admission, as compared to group O or B patients

Also showed decreased prevalence of infection in blood group O individuals. This study estimated ABO blood group as a risk factor for SARS-CoV-2 infection but not for hospitalization or death from COVID-19 Taken together, these studies show that the risk of infection with SARS-CoV-2 and the risk of severe COVID-19 disease may be lower in group O individuals than in non-group O individuals. [18,19]

Mechanisms of associations between ABO blood groups and COVID-19 , there are several proposed path physiological mechanisms which illustrate the association between ABO blood group and SARS-COV-2 infection , first proposed mechanism , Anti-A and /or anti-B antibodies may bind to A and /or B antigens expressed on the viral envelope , by preventing infection of target cells , these naturally occurring antibodies could function as viral neutralizing antibodies , If this proposed true , this may clarify differences in initial infinity for SARS-COV-2 infection.

For example, an anti-A viral neutralizing antibody in a potentially susceptible group O host would bind the A antigen on virus produced by, and inhaled from, an infected group A (or group AB) host .Why this mechanism would be relevant to disease severity per se is less obvious, because subsequent rounds of viral proliferation in a group O host would produce a virus expressing the H antigen on its envelope. However, assuming that disease severity relates to the size of the infecting inoculums and yielding the subsequent viral load, a neutralizing isoagglutinin (e.g. anti-A) could attenuate infection, if not prevent infection altogether. Finally, the entry barrier for

this virus is the epithelium of the respiratory tract and, possibly, the digestive tract. Thus, to prevent infection, circulating antibodies may need to reach these cell surfaces; although, presumably, the most effective antibodies for this purpose are of the secretary IgA isotype, to date, no data are available about the IgA isotype for either anti-A and/or anti-B in this regard[20].

Another potential mechanism for explaining an association between group A and severe COVID-19 is an increase in angiotensin-converting enzyme 1 (ACE-1) activity, with a predisposition to cardiovascular complications. Severe outcomes could also be explained by higher levels of VWF and factor VIII in groups and individuals. Furthermore, VWF is an acute phase reactant with infection inducing even higher levels in groups and individuals. Given that anti-A and anti-B antibody titers are highly variable among individuals [21] the potential neutralizing effect of such antibodies is also expected to be highly variable [22] possibly obscuring the 'signal' in large population studies. This variability may be further compounded by the significantly higher binding affinity of SARS-CoV-2 S proteins for ACE2R, as compared to SARS-CoV [23].

Conclusion:

in some of current pandemic disease it is important to focus on the high –risk groups for severe infection and death as some studies suggest that the blood group may interaction with susceptibility to COVID 19 and our study has found that blood groups A^+ and O^+ disposed to COVID19 infection respectively . These results could encourage individuals with a high risk of severe infection being vaccinated earlier. The limitation of this study was the small sample size and additional studies with a large number of patients are required to confirm this association.

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