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Journal of Medical and Life Science
https://jmals.journals.ekb.eg/

Association between ABO blood group and susceptibility to COVID-19 infection in Egypt

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DOI:10.21608/jmals.2022.421025

Abstract:

Background: many studies reported an associated between ABO blood groups and COVID-19 susceptibility and disease severity. **Materials and methods:** The data was obtained from data records of Alyameny laboratory files in Alexandria city, Egypt, for 504 COVID-19 mildly infected patients were collected from data records in 3 years (2020- 2022), in Al-Raml District, Alexandria city, Egypt and compared with the prevalence distribution of blood groups in the same district in previous study. **Results:** This study showed that blood group A had the highest COVID-19 infection percentage (45.1%), and the infection of O, B, and AB blood groups was 22.6%, 21%, and 11.3%, respectively, the COVID-19 infection susceptibility in blood group A > O> B> AB, also the blood group A had the highest distribution (32.4%), and the distribution of O, B, and AB blood groups was 31.8%, 25.3%, and 10.5%, respectively, blood group distribution in blood group A > O> B> AB in the same manner as the percentage of COVID 19 infection, so this research demonstrated there is no associations between ABO blood group and susceptibility to COVID-19 mild infection.

Conclusion: This research demonstrated there is no association between ABO blood group and susceptibility to COVID-19 mild infection, the relationship between blood group, COVID-19 infection, and disease susceptibility or severity is still under debate and not fully understood.

Keywords: ABO, blood group, COVID-19, susceptibility.

Introduction:

The World Health Organization (WHO) received several reports of unidentified pneumonia from Wuhan, China, on December 31, 2019. On January 7, 2020, the cause of the reported cases was identified as the 2019 novel coronavirus (2019-nCoV). The disease was later named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease 2019 (COVID-19). The WHO declared the outbreak a global health emergency on January 30, 2020 (1).

The COVID-19 pandemic is affecting human health across the globe, with some people being more susceptible to the infection than others, although variation in clinical features in SARS-CoV-2-infected individuals is commonly observed. Epidemiological studies show that around 80% of the infected individuals are asymptomatic but

Received: September 10, 2022. Accepted: November 21, 2022. Published: December 4, 2022

contagious, while others experience mild symptoms, such as cough and fever, or severe respiratory complications, such as the acute respiratory distress syndrome (ARDS) (2).

It was believed that variations in the body's immune response to the infection were the cause of this diversity in COVID-19 clinical characteristics. While an overwhelming immune response might result in an excessive inflammatory reaction that has serious negative effects, an early, effective immune response can lower the viral load and stop the infection from getting to the lungs (3).

Moreover, statistics show an increased prevalence of diabetes, hypertension, and liver diseases among severe COVID-19 cases, suggesting that metabolic disorders have a role in directing the response of the body to the infection (4).

The ABO blood group system is the first established human blood groups based upon antigens present on red cell membranes. Further research found ABO antigen not only exists on the surface of red blood cells, but also widely exists in some epithelial cells and various body fluids (5)

The ABO blood group is the most important among human blood group systems and consists of complex carbohydrate moieties at the extracellular surface of red blood cell (RBC) membrane (5,6).

Although the physiological role of ABO antigens and their related anti-A and anti-B natural isoagglutinins is still largely unknown, they play a prominent role in blood transfusion and cell, tissue, and organ transplantation (7). In addition, several studies over the last 50 years have documented a close link between ABO blood groups and a wide array of diseases, including cancers and cardiovascular disorders (8).

ABO blood group antigens can affect disease susceptibility through a variety of mechanisms, including acting as a receptor for pathogens and regulating immune responses in the form of antibodies (9).

The impact of the ABO blood group system on the COVID-19 susceptibility was first reported by Zhao et al. in confirmed COVID-19 cases at three different hospitals in China, It was found that patients with blood group A had a higher COVID-19 infection rate, as compared to patients with blood group O, especially in a region where the prevalence of blood groups A and O among the population is 31% and 34%, respectively (10).

In particular, it has been hypothesised that individuals belonging to O blood type are less susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection than those belonging to non-O blood groups or that they have a milder disease (11) However, the results of studies conducted in the U.S. are different, they found that people with blood group B have a higher risk of SARS-CoV-2 infection (12).

Although these associations and their potential implications remain unclear; some underlying mechanisms have been hypothesized, like a protective effect of the ABO antibodies (13), and a role for ABO(H) antigens in facilitating viral entry into target cells. Thus, this research aims to review the associations between ABO blood group and susceptibility to COVID-19 mild infection.

Materials and methods:

The data was obtained from data records of Alyameny laboratory files in Alexandria city, Egypt, for 504 COVID-19 mildly infected patients were collected from data records in 3 years (2020- 2022), in Al-Raml

District, Alexandria city, Egypt and compared with the prevalence percentage of blood groups in the same district in previous study (6), the residence of this district coming from most Egyptian governorates from Alexandria to Aswan, so this study near to be about Prevalence of ABO and Rh blood groups in Egypt with limitation in the number of participants is only 5928.

Statistical Analysis:

The data of 504 COVID-19 mildly infected patients was collected in an Excel sheet to calculate the total number infected in each blood group and the percentage of prevalence for each blood group and compared with blood groups distribution in the same district in the previous study.

Results:

The data was obtained from data records of Alyameny laboratory files in Alexandria city, Egypt, for 504 COVID-19 mildly infected patients were collected from data records in 3 years (2020- 2022), in Alexandria city, Egypt.

This study showed that blood group A had the highest COVID-19 infection percentage (45.1%), and the infection percentages of O, B, and AB blood groups was 22.6%, 21%, and 11.3%, respectively, as shown in Table 1 and Figure 1, the COVID 19 infection susceptibility in blood group A > O> B> AB, also the blood group A had the highest distribution (32.4%), and the distribution of O, B, and AB blood groups was 31.8%, 25.3%, and 10.5%, respectively, blood group distribution in blood group A > O> B> AB in the same manner as the percentage of COVID 19 infection, so this research demonstrated there is no associations between ABO blood group and susceptibility to COVID-19 mild infection.

Table 1: Percentages of **ABO** blood group distribution and COVID-19 infection.

Blood group	COVID-19 infection percentage (504 patients)	Blood group distribution percentage (5928 individuals)
A	45.1%	32.4%
O	22.6%	31.8%
B	21%	25.5%
AB	11.3%	10.5%

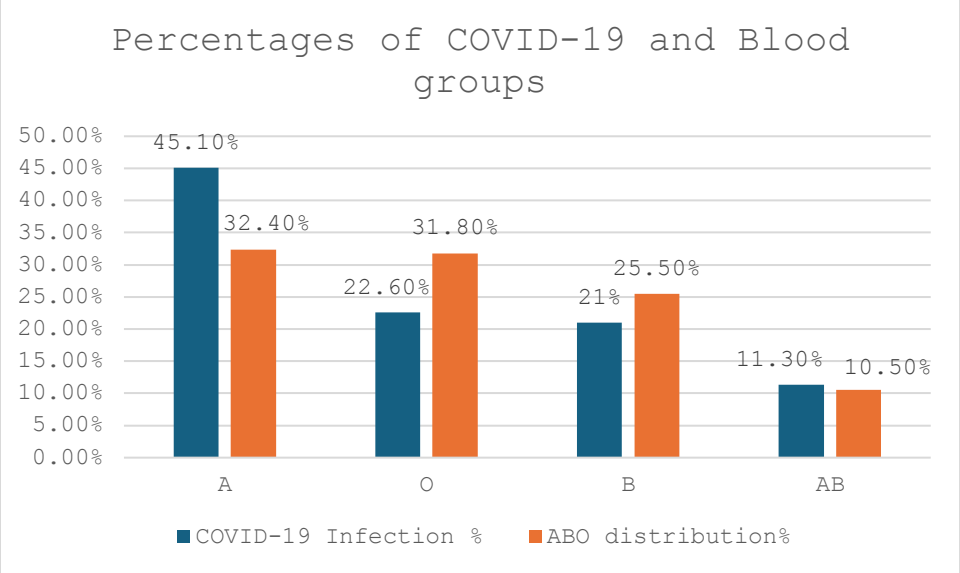

Figure 1: Correlation between **ABO** blood group distribution and COVID-19 infection.

Discussion:

SARS-CoV-2 and the severity of COVID-19 are yet to be fully understood. The ABO blood grouping may influence the susceptibility of COVID-19 and severity of the disease (10), the theory that individuals belonging to O blood type are less susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection than those belonging to non-O blood groups or that they have a milder disease, blood type O carriers have a higher interleukin 6 (IL-6) level than non-type O carriers (14).

IL-6 is a proinflammatory cytokine triggering the production of acute-phase proteins such as C-reactive protein. As higher levels of C-reactive protein were detected among ACE-inhibitor-induced coughers than controls (15,16), ferritin increased with COVID-19 infection as an inflammatory marker (17), which may have led to a cytokine storm with a high level of D-dimer 36.4% in out-hospitalized patients with COVID-19 (18), although COVID-19 mild infection showed normal platelet count and normal level of the inflammatory marker Tumor Necrosis Factor-alpha (TNF-α) (19,20) with increasing the neutrophil cells percentage and decreasing the lymphocyte cells percentage in peripheral blood circulation (21).

This study showed that blood group A had the highest COVID-19 infection percentage (45.1%), and the frequency of O, B, and AB blood groups was 22.6%, 21%, and 11.3%, respectively, as shown in Table 1 and Figure 1, the COVID 19 infection susceptibility in blood group A > O> B> AB, also the blood group A had the highest frequency (32.4%), and the frequency of O, B, and AB blood groups was 31.8%, 25.3%, and 10.5%, respectively, blood group distribution in blood group A > O> B> AB in the same manner as the percentage of COVID 19 infection, so this research demonstrated there is no associations between ABO blood group and susceptibility to COVID-19 mild infection.

Zhao et al. reported that patients with blood group A had a higher COVID-19 infection rate as compared to patients with blood group O, especially in a region where the prevalence of blood groups A is 31% less than blood group O at 34% among the populations (10).

In line with findings from China, studies from Turkey, Lebanon, Iraq and Denmark also demonstrated that patients with blood group A represented the highest proportion of COVID-19 positive cases, when compared to the other blood groups and that furthermore, the blood group with the lowest number of infected individuals was reported to be the O type (22-25).

However, the results of studies conducted in the U.S. are different, they found that people with blood group B have a higher risk of SARS-CoV-2 infection (12).

Although, a large number of studies reported an associated between ABO blood groups and COVID-19 susceptibility and disease severity, currently there are no specific COVID-19 interventions based on the patient blood groups. These findings have not yet been used as clinical evidence to deliver personalized medicine to more susceptible individuals.

Additionally, viral infection has not been modelled using population blood group type to forecast the future trajectory of an outbreak or assess methods for controlling the spread of infection.

This is because the relationship between blood group, COVID-19 infection, and disease susceptibility or severity is still under debate and not fully understood.

Conflict of interest: NIL

Funding: NIL

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