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Clinical characteristics and ABO blood groups in COVID-19 patients, Saudi Arabia

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Abstract

This study assessed the proportion of ABO blood groups and clinical characteristics among Saudi patients with coronavirus disease 2019 (COVID-19) in Jazan, Saudi Arabia.

This retrospective cohort study included 404 Saudi adults with COVID-19, confirmed by the real-time reverse transcription-polymerase chain reaction. The participants were selected randomly between July 1, 2020, and July 31, 2020, from the Health Electronic Surveillance Network system, which contains the primary data on COVID-19 infections in Jazan.

Blood type O (62.4%) represented the highest proportion in COVID-19 Saudi patients followed by the other blood groups which distributed as follows: blood type A (25.5%), blood type B (10.1%), and blood type AB (2%). Men, and people aged 18–44 years, represented the higher percentage than women and those of a younger age. The majority of the patients with COVID-19 had clinical symptoms (88.4%), and the remainder (11.6%) were asymptomatic. Ninety four percent of the patients had mild COVID-19 symptoms and self-isolated at home. Only 6.4% of the cases were severe and admitted to hospital. There was no significant association between a specific ABO blood group and COVID-19 clinical symptoms ($P = .950$), incubation period ($P = .780$), disease duration ($P = .430$), and disease severity ($P = .340$). Old age and diabetes were the significant predictors of COVID-19 severity and hospital admission ($P = .010$).

Blood group O represented the highest proportion of COVID-19 Saudi patients as it is the most common blood group in Saudi individuals in Jazan. However, no specific blood group was associated with COVID-19 severity and hospital admission. Old age and diabetes mellitus were shown to be significant predictors of severe COVID-19 and hospital admission.

Abbreviations: BMI = body mass index, COVID-19 = coronavirus disease 2019.

Keywords: ABO blood groups, blood types, coronavirus disease 2019, acute respiratory syndrome coronavirus 2

1. Introduction

The novel coronavirus disease 2019 (COVID-19) is a pandemic infectious disease, caused by severe acute respiratory syndrome coronavirus-2.[1] It has spread rapidly across the globe, infecting over 29 million people, and, by September 15, 2020, had caused over 900,000 deaths.[1] On this date, the Saudi Ministry of Health reported that there were 11,088 confirmed cases of COVID-19 infection in the Jazan region, South West of Saudi Arabia.[2] The clinical characteristics of COVID-19 in mild cases are fever, cough, shortness of breath, difficulty breathing, fatigue, headache, loss of taste or smell, sore throat, congestion, a runny nose, nausea, vomiting, and diarrhea.[3] These symptoms may become severe in elderly and patients with comorbidities and require intubation in hospital admission.[4–6]

Several studies have assessed the relationship between the proportion of patients with a specific ABO blood group (i.e., type A, type B, type O, or type AB) and clinical severity in COVID-19 patients.[7–14] In a USA study, it was reported that blood type O (45%) was the most common blood type in patients with COVID-19; however, an association was not established between blood type and COVID-19 clinical severity, and this was also applicable to hospital admission and intubation.[7] In Iran, a study indicated that blood group AB was the most common in patients with COVID-19.[14] However, many studies have shown that, of all the blood groups, type A is the most common in COVID-19 patients.[8,13] Nevertheless, most of these studies did not find a correlation between a specific ABO blood group type and COVID-19 severity.[8,13]

However, further studies are required especially in a large country, such as Saudi Arabia where there is a paucity of data on the topic to assess the proportion of ABO blood groups in patients with COVID-19 and its severity since the findings in the

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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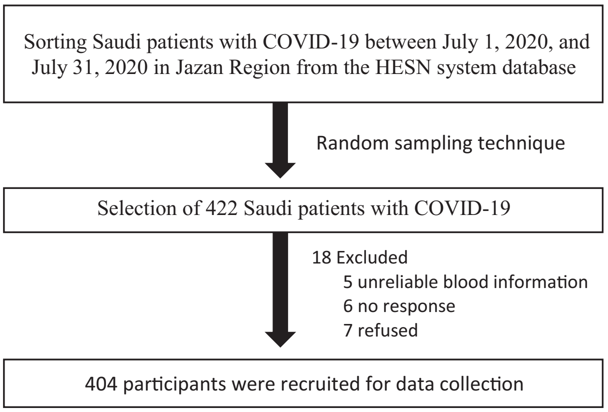

Figure 1. Patient enrolment and the sampling technique in the current study.

existing literature vary owing to genetic and ethnic differences among the populations studied. In addition, to the best of our knowledge, such topic has not yet been evaluated in Jazan, Saudi Arabia. Therefore, this study aimed to assess the proportion of ABO blood groups and clinical characteristics among Saudi patients with COVID-19 in Jazan, Saudi Arabia.

2. Method

2.1. Study settings and design

Jazan Region is located in the south–west corner of Saudi Arabia; it comprises a predominantly homogenous population (1,500,000) with similar ethnic and socioeconomic characteristics.[15–17] A retrospective cohort study enrolled Saudi patients with COVID-19 in Jazan, Saudi Arabia between July 1, 2020, and July 31, 2020. COVID-19 patients are registered in the Health Electronic Surveillance Network system, the country's official central epidemiological surveillance program, and is considered the main source of data for patients infected with COVID-19 in Jazan. Thus, Saudi patients with COVID-19 were randomly selected from the health electronic surveillance network system database (Fig. 1). The Jazan Health Institutional Review Board (Reference number: H-10-Z-073) granted ethical approval (No. 2030) for the study to be conducted, and the research complied with the Declaration of Helenski. Consent was obtained from all the participants before enrolment.

2.2. Sample size

The sample size was calculated using Epi Info.[18] The following parameters were utilized: 95% confidence interval, alpha of 0.5, and expected frequency of 50%. The appropriate sample size was computed to be 384, but the total calculated sample size was increased by 10% (n = 38 participants) to mitigate the lack of response by non-respondents. Four hundred four of the 422 selected participants were successfully recruited. Six of the selected participants (1.4%) did not respond, 5 (1.2%) were excluded owing to unreliable blood information, and 7 (1.6%) refused to take part in the study (Fig. 1).

2.3. Data collection and statistical analysis

Data were collected retrospectively including demographic characteristics, age, sex, marital status, education level, smoking history, co-morbidities, clinical history in relation to COVID-19, date of contact with a COVID-19 infected patient, date of COVID-19 clinical symptom onset, home isolation or hospital admission with intubation, and date of recovery from COVID-19. In addition to anthropometric and laboratory measurements including body mass index (BMI) and blood type (ABO blood group system).

Co-morbidities included cardiovascular disease, chronic kidney disease, diabetes mellitus, and obesity. The clinical symptoms of COVID-19 included fever, cough, shortness of breathing (dyspnea), loss of taste and smell (anosmia), chest pain, sore throat, congestion, a runny nose, fatigue, headache, diarrhea, and vomiting. The diagnosis of COVID-19 infection was confirmed by the identification of viral RNA in a nasopharyngeal swab sample using real-time reverse transcription–polymerase chain reaction (RT-PCR) (LightCycler 480 Instrument II, Roche). ABO blood type identification was determined using ID-Centrifuge 12 S II (Bio-Rad). Disease severity was categorized according to the World Health Organization guidelines.[19] Severe cases were defined as those with oxygen saturation of $\leq$90%, a respiratory rate of $\geq$30 breaths per minute, and signs of severe respiratory distress. The incubation period was calculated in days and constituted the period between exposure to acute respiratory syndrome coronavirus 2 and the manifestation of clinical symptoms. Disease duration was calculated in days and was considered to be the period between the manifestation of clinical symptoms of COVID-19 and the date of recovery. The criteria for recovery were based on the guidelines of the Ministry of Health, Saudi Arabia; recovery was considered to have occurred when at least 3 days had passed after the resolution of fever and respiratory symptoms and after obtaining 2 negative PCR samples results taken $\geq$24 hours apart; alternatively, at least 10 days had to have passed since symptom onset.[20] In keeping with the World Health Organization guidelines,[21] BMI was calculated as weight in kilograms divided by the square of the person's height in meters. A BMI score of $\geq$30 was categorized as obese.

2.4. Statistical analysis

Data entry and analysis were performed using Statistical Package for the Social Sciences software.[22] The continuous variables were described as means $\pm$ standard deviation, and the categorical variables were presented as percentages and frequencies. The chi-square test and Fisher exact test were used to assess any significant associations between the categorical variables. Univariate analysis was performed with adjustment for covariates. Logistic regression analysis was employed to identify predictors of COVID-19 disease severity. A P value of <.050 was considered to be statistically significant.

3. Results

Four hundred four patients with COVID-19 were recruited in the current study. The participants' sociodemographic characteristics and health risks are depicted in Table 1. The mean age of the participants was 39.5 $\pm$ 14.8 years (a range of 18–81 years). The mean BMI was 26.8 $\pm$ 5.9 (a range of 13.4–45.8). The majority of the participants, 252 (62.4%) had type O blood; 103 (25.5%) had type A blood; 41 had type B blood (10.1%); and 8 had type AB blood (2.0%).

Table 1

Sociodemographic characteristics and health risks of the study population.

Factor	Overall (n=404)	Blood group n (%)				P
		O (n=252)	A (n=103)	B (n=41)	AB (n=8)	
Age						
18–44	276 (68.3%)	175 (69.4%)	64 (62.1%)	29 (70.7%)	7 (87.5%)	.65
45–64	93 (23.0%)	51 (20.3%)	31 (30.1%)	9 (22.0%)	1 (12.5%)	
65–81	35 (8.7%)	26 (10.3%)	8 (7.8%)	3 (7.3%)	0	
Sex						
Male	251 (62.1%)	153 (60.7%)	64 (62.1%)	29 (70.7%)	4 (50%)	.62
Female	153 (37.9%)	99 (39.3%)	39 (37.9%)	12 (29.3%)	4 (50%)	
Marital status						
Single	97 (24.0%)	52 (20.6%)	27 (26.2%)	14 (34.1%)	4 (50.0%)	.05
Married	285 (70.5%)	190 (75.4%)	67 (65.0%)	25 (61.0%)	3 (37.5%)	
Widowed	7 (1.7%)	1 (0.4%)	5 (4.9%)	0	0	
Divorced	15 (3.8%)	9 (3.6%)	4 (3.9%)	2 (4.9%)	1 (12.5%)	
Education level						
Illiterate	33 (8.2%)	23 (9.1%)	6 (5.8%)	4 (9.7%)	0	.39
Primary	59 (14.6%)	44 (17.5%)	14 (13.6%)	0	1 (12.5%)	
Secondary	131 (32.4%)	80 (31.7%)	33 (32.1%)	17 (41.5%)	2 (25.0%)	
University	181 (44.8%)	105 (41.7%)	50 (48.5%)	20 (48.8%)	5 (62.5%)	
Smoking						
No	344 (85.1%)	218 (86.5%)	87 (84.5%)	31 (75.6%)	8 (100%)	.26
Yes	60 (14.9%)	34 (13.5%)	16 (15.5%)	10 (24.4%)	0	
Diabetes						
No	325 (80.4%)	206 (81.7%)	78 (76.7%)	33 (80.5%)	5 (62.5%)	.74
Yes	79 (19.6%)	46 (18.3%)	25 (24.3%)	8 (19.5%)	3 (37.5%)	
Body mass index						
Not obese	308 (76.2%)	193 (76.6%)	80 (77.7%)	31 (75.6%)	5 (62.5%)	.94
Obese	96 (23.8%)	59 (23.4%)	23 (22.3%)	10 (24.4%)	3 (37.5%)	

3.1. Clinical symptoms of COVID-19 in relation to blood group

Forty six (11.6%) of the patients infected with COVID-19 were asymptomatic and 357 (88.4%) had symptoms. The distribution of the clinical symptoms of COVID-19 among the different blood groups is shown in Table 2. A statistically significant association between COVID-19 symptoms and blood group was not established (Table 2).

3.2. Incubation period and disease duration

The mean incubation period and disease duration were (5.19 ± 3.02) days and (8.49 ± 6.57) days, respectively (respective ranges of 2–15 days and 5–43 days). Univariate analysis was used to identify the mean differences in incubation period and disease duration between blood groups of participants adjusted for age and BMI, however, the differences in incubation period and disease duration means were without statistical significance ($P=.870$ and $P=.180$, respectively) (Table 3).

3.3. COVID-19 severity in relation to blood groups

The majority of COVID-19 participants had mild symptoms (93.6%) and self-isolated at home. Only 6.4% of the study population were severe cases and admitted to hospital with intubation. The association between disease severity and the blood groups was not statistically significant ($P=.340$) (Table 4). In logistic regression analysis, diabetes was the most predictor of COVID-19 severity and hospital admission ($P=<.010$, odds ratio of 2.4) (Table 5); COVID-19 patients with diabetes were at greater risk (2 times higher) of severe illness compared to others.

4. Discussion

Human cells and tissues, including red blood cells, contain carbohydrate-based complex antigens, referred to as histo-blood group antigens. These are expressed on the surface of the red blood cell membranes and play an important role in increasing or decreasing the risk of susceptibility to infection.[10,23–25] Some studies have explored the proportion of blood groups in COVID-19 patients.[7–14] However, further studies are warranted owing to large variations (i.e., genetic factors and ethnic differences) in previous studies, which may have impacted the results. To the best of knowledge, the current study is the first assessed the proportion of blood groups among Saudi patients with COVID-19 in Jazan, Saudi Arabia.

In our study, we found that type O blood (62.4%) represented the highest proportion in Saudi patients with COVID-19, followed by type A blood (25.5%). These results are consistent with the findings of a USA study that reported that the prevalence of COVID-19 was higher in patients with type O blood (45.5%) and type A blood (34.2%); similarly, an association was not found between blood group and the severity of COVID-19 clinically.[7] However, in Turkey and China, type A blood was observed to correlate with the highest prevalence of COVID-19 infection.[8,9,11] In Iran, AB blood group patients were shown to be at increased risk to COVID-19 infection, compared to other blood groups.[14] However, this difference might have been owing to the frequency and prevalence of blood groups other

Table 2

COVID-19 clinical symptoms distribution in patients with different blood groups.

Clinical symptoms	Overall (n=404)	Blood Group n (%) O (n=252)	A (n=103)	B (n=41)	AB (n=8)	*P*
Presence of symptoms						
Asymptomatic	47 (11.6%)	27 (10.7%)	13 (12.6%)	5 (12.2%)	1 (12.5%)	.95
Symptomatic	357 (88.4%)	225 (89.3%)	90 (87.4%)	36 (87.8%)	7 (87.5%)	
Fever						
No	181 (44.8%)	110 (43.7%)	49 (47.6%)	18 (43.9%)	4 (50.0%)	.93
Yes	223 (55.2%)	142 (56.3%)	54 (52.4%)	23 (56.1%)	4 (50.0%)	
Cough						
No	262 (64.9%)	166 (65.9%)	64 (62.1%)	24 (58.5%)	7 (87.5%)	.65
Yes	142 (35.1%)	86 (34.1%)	39 (37.9%)	17 (41.5%)	1 (12.5%)	
Dyspnea						
No	305 (75.5%)	196 (77.8%)	73 (70.9%)	31 (75.6%)	4 (50.0%)	.34
Yes	99 (24.5%)	56 (22.2%)	30 (29.1%)	10 (24.4%)	4 (50.0%)	
Anosmia						
No	206 (51.0%)	123 (48.8%)	54 (52.4%)	24 (58.5%)	5 (62.5%)	.58
Yes	198 (49.0%)	129 (51.2%)	49 (47.6%)	17 (41.5%)	3 (37.5%)	
Chest pain						
No	329 (81.5%)	208 (82.5%)	84 (81.6%)	32 (78.0%)	5 (62.5%)	.74
Yes	75 (18.5%)	44 (17.5%)	19 (18.4%)	9 (22.0%)	3 (37.5%)	
Sore throat						
No	299 (74.1%)	180 (71.4%)	80 (77.7%)	35 (85.4%)	5 (62.5%)	.36
Yes	105 (25.9%)	72 (28.6%)	23 (22.3%)	6 (14.6%)	3 (37.5%)	
Congestion and runny nose						
No	331 (82.0%)	214 (84.9%)	74 (71.8%)	37 (90.2%)	5 (62.5%)	.05
Yes	73 (18.0%)	38 (15.1%)	29 (28.2%)	4 (9.8%)	3 (37.5%)	
Fatigue						
No	236 (58.5%)	138 (54.8%)	62 (60.2%)	31 (75.6%)	5 (62.5%)	.18
Yes	168 (41.5%)	114 (45.2%)	41 (39.8%)	10 (24.4%)	3 (37.5%)	
Headache						
No	198 (49.0%)	124 (49.2%)	46 (44.7%)	23 (56.1%)	4 (50.0%)	.76
Yes	206 (51.0%)	128 (50.8%)	57 (55.3%)	18 (43.9%)	4 (50.0%)	
Diarrhea						
No	298 (73.8%)	188 (74.6%)	72 (69.9%)	31 (75.6%)	7 (87.5%)	.79
Yes	106 (26.2%)	64 (25.4%)	31 (30.1%)	10 (24.4%)	1 (12.5%)	
Vomiting						
No	379 (93.8%)	238 (94.4%)	94 (91.3%)	41 (100%)	7 (87.5%)	.23
Yes	25 (6.2%)	14 (5.6%)	9 (8.7%)	0	1 (12.5%)	

Table 3

Incubation period and disease duration adjusted for age and BMI.

Variable	Blood group (Mean±SD*) O (n=252)	A (n=103)	B (n=41)	AB (n=8)	*P*
Incubation period	5.1±3.8	5.5±5.1	5.6±2.8	3.5±0.7	.87
Disease duration	8.4±6.4	7.6±5.2	10.1±10.7	6.0±3.7	.18

* SD (standard deviation).

Table 4

Severity of COVID-19 and blood groups using Chi-Squared test.

Severity	Overall (n=404)	Blood group (Mean±SD*) O (n=252)	A (n=103)	B (n=41)	AB (n=8)	*P*
Non-severe	378 (93.6%)	235 (93.3%)	99 (96.1%)	36 (87.8%)	8 (100%)	.34
Severe	26 (6.4%)	17 (6.7%)	4 (3.9%)	5 (12.2%)	0	

* SD (standard deviation).

Table 5

Predictors of COVID-19 severity and hospital admission using logistic regression.

Predictor	*P* value	OR	(CI 95%)
Age	.02*	1.8	(0.98–2.35)
Sex	.27	1.7	(0.65–4.71)
Diabetes	<.01*	2.6	(0.90–7.71)
Smoking	.72	1.6	(0.15–3.60)
BMI	.25	1.05	(0.97–1.13)
Blood group (O)	.79	1.1	(0.44–2.93)
Blood group (A)	.26	1.2	(0.14–1.74)
Blood group (B)	.14	1.9	(0.74–7.57)
Blood group (AB)	.52	1.1	(0.96–1.4)

* Significant results (*P* value <.05).

than increased risk of COVID-19 susceptibility. In Jazan, type O blood was predominantly identified (62%) in Saudi people, followed by type A blood (27.6%), type B blood (8.7%), and type AB blood (1.7%).[26] This suggests that it is likely that the rate of COVID-19 infection is highest in patients with type O blood, compared to other blood types, in Jazan, Saudi Arabia.

Although the percentage of severe cases was identified in patients with blood group type O (6.7%) in the current study, the results of the Chi-Squared test and logistic regression analysis demonstrated that blood group type was not significantly predictive of clinically severe outcomes in COVID-19 patients. Old age and diabetes were shown to significantly affect clinical outcomes, similar to the findings of previous studies.[4–6] In terms of demographic characteristics, men, and people aged 18 to 44 years, were more likely to be infected with COVID-19. The relatively high infection of men and adults aged 18 to 44 years, compared to others, could be explained by the fact that they are more mobile and thus are at increased risk of infection. In addition, smoking and obesity were not associated with increased risk of COVID-19 infection. The majority of the participants had the clinical symptoms of COVID-19, but the differences between the blood groups in this regard were not statistically significant.

4.1. Limitations

Establishing the causal association are important aims for future studies. The Chi-Squared test did not adjust for confounders.

Author contributions

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