ORIGINAL ARTICLE

ABO Blood Group System and Covid-19 Susceptibility in Different Ethnic Groups of Medical Students in Karachi

Noorulain Thebo[1], Shah Jabeen[2], Asma Shahid[1], Muhammad Athar Khan[3], Sassi Kanwal[4] and Shahida Kashif[5]

ABSTRACT

Objectives: To determine the frequency of blood groups in different ethnicities among medical students of Karachi and the association of blood groups with Covid-19 susceptibility

Methodology: A cross sectional study was conducted among medical and dental students of Liaquat College of Medicine and Dentistry from January 1st to October 30th, 2019 after taking Institutional Review Board's approval. Data was collected from students of different ethnicities. Blood group was determined by mixing the blood with antisera and observing the agglutination by antigen and antibody reaction. Screening for Covid 19 was carried out by reverse transcription polymerase chain reaction real-time (RT-PCR)

Result: In our study, data was collected from 220 medical students, out of whom 89 (40.5%) were male. Their ages ranged from 17-22 years with mean age of 19.5±2.39 years. Among 220 students, group B was the most common blood group, accounting for 77 (35%) participants. Screening, the most susceptible blood group for Covid 19 virus was found to be blood group B (61%).

Conclusion: According to ethnicity, blood group B was the most common group in Punjabi and Urdu speaking populations while among Sindhis, A and O were the prevalent groups. The Rh positive group was found to be more susceptible to Covid-19 virus and blood type B^+ was revealed to be in higher association with it.

Key Words: ABO blood group, Blood group, Covid-19, Ethnicity, Medical students

How to cite this article: Thebo N, Jabeen S, Shahid A, Khan MA, Kanwal S, Kashif S. ABO blood group system and covid-19 susceptibility in different ethnic groups of medical students in Karachi. Ann Jinnah Sindh Med Uni. 2021;7(2):55-59

DOI: https://doi.org/10.46663/ajsmu.v7i2.55-59

INTRODUCTION

Covid-19 emerged in the Wuhan city of China in December 2019. The World Health Organization (WHO) declared it a pandemic on March 11, 2020 when millions of people were afflicted all over the world[1]. On February 26, 2020, Pakistan documented its first case. As of January 28th, 2021, there were 539,387 confirmed cases along with 11, 5142 deaths.

The ABO blood grouping system was the first defined genetic polymorphism in humans. These agglutinogens are hereditary characters that have been found very helpful in genetic studies and researching disease pattern after population migrations[3]. The distribution of ABO and RhD blood groups differs all over the world[4,5]. Out of 300 blood group antigens, ABO system and Rh is the most common in the world. In 1900, Karl Landsteiner introduced the system, based on the presence of agglutinogens on red blood cells surface and presence of reciprocal agglutinins in the plasma. In spite of the discovery of a large number of red cell antigens, no blood antigen group could gain more importance than ABO and Rh system[6].

This blood group system is the most significant for blood transfusion, organ transplantation, and medico-legal purposes[7]. As the blood group antigens represent polymorphic traits that are inherited by individuals, various studies have revealed the contribution of ABO blood groups in distribution of many acute and chronic pathologies, such as cardiovascular diseases, oncological presentations, or even some infectious diseases[8]. It has been found that, AB antigens and their antibodies can play a pivotal role as acting receptors or co receptors for different viruses, bacteria, and parasites.[9]

Demonstrator[1], Associate Professor[3], Assistant Professor[5], Liaquat College of Medicine and Dentistry. Karachi, Pakistan

2 Assistant Professor, Fazaia Ruth Pfau Medical College, Karachi, Pakistan

3 Assistant Professor, Jinnah Medical & Dental College, Karachi, Pakistan

Correspondence: Shah Jabeen, Assistant Professor, Fazaia Ruth Pfau Medical College, Karachi

Email: khanshahjabeen@gmail.com

The ABO and Rh blood groups differ distinctly in various ethnicities and races of the world[10]. Several studies have revealed that the prevalence of the ABO/Rh blood group type's allelic distribution among variable ethnic populations and different geographical areas of the world, is mainly due to ABO/Rh genes' genetic polymorphism characters[11].

Although significant research has been done in the field of individualization of risk and several acquired and congenital factors have already been documented, however, less weightage is given to the certain more influential demographic variables like age, gender, and ethnicity[12].

Expression of blood type antigens can alter any individual's susceptibility to various diseases by facilitating intracellular uptake, adhesion to membrane micro domains, or simply by signal transduction. Elnady et al. found that gastroenteritis by rotavirus was more common among blood type A individuals and similarly, blood group O was found to lower the hepatitis B viral infection risk[13]. Another study revealed that malarial patients with blood type A had a greater probability of being anaemic than patients with O and non-A phenotypes, just due to modification in the inborn or innate immune reaction to any disease by blood group antigens[14].

All these researches reveal that there is a strong connection between infectious diseases pathology and blood groups antigens and their antibodies.

The purpose of ABO/Rh blood type distribution among any variable ethnic population would be an optimum approach for healthcare system planning and further future counseling. The trend of blood types and its ethnic distributions in the city of Karachi, which is the main hub of different ethnicities is still unknown. As SARS-CoV-2 also known as Covid-19 is a novel virus with multiple strains, the ABO blood group and its linkage with Covid-19 susceptibility is still not documented and yet to be deciphered. This study will add to the international pool of data on association of ABO-Rh blood types and Covid-19. The results of the study would help in risk stratification and in prioritizing vaccination for the most vulnerable group for Covid-19 according to the prevalent blood group.

METHODOLOGY

A cross sectional study was conducted among medical and dental students of Liaquat College of Medicine and Dentistry from January 1 to October 30, 2019 after taking Institutional Review Board's approval. The sample size was calculated with Raosoft using 95% confidence level, margin of error 6.5%, and 40.4% frequency of blood group B[15]. The minimum sample size was 217. We enrolled a total of 220 young and healthy students. Data was collected from students of different ethnicities i.e. Urdu speaking, Sindhi, and Punjabi. Questionnaire consisted of name, age, caste, and area of residence. From each participant, 4 ml of blood was taken in EDTA tubes. Tube method with commercially prepared anti seras, (anti-A, anti-B, anti-AB, and anti-D) was used to analyze ABO and Rh types. Using the first 5%, suspensions of red blood cells in normal saline were prepared and four tubes were made and labelled with respective ID numbers. Then one drop of each suspension and antisera A, B, AB and D were added and agglutination was observed macroscopically. Screening for Covid-19 was carried out by collecting specimens from nasal swab and considered as Covid-19 nuclear acid test positive for viral nucleic acid by reverse transcription polymerase chain reaction real-time (RT-PCR). SPSS version 20 was used for analyzing data. Data were expressed as percentages for categorical variables such as ABO blood types, ethnicity, gender etc. For the association between blood group and gender, Covid-19 and ethnic origin, the Chi square test was utilized and p value of ≤ 0.05 was considered as the level of statistical significance.

RESULTS

In our study, data was collected from 220 medical and dental students, out of whom 89 (40.5%) were male and 131 (59.5%) were female participants. Their ages ranged from 17-22 years with the mean age of 19.5± 2.39 years. Among 220 students, group B was the most common blood group, accounting for 77 (35%), followed by groups A 65 (29.6%) and O with 67 (30.4%), and the least common group was AB 11 (5%).

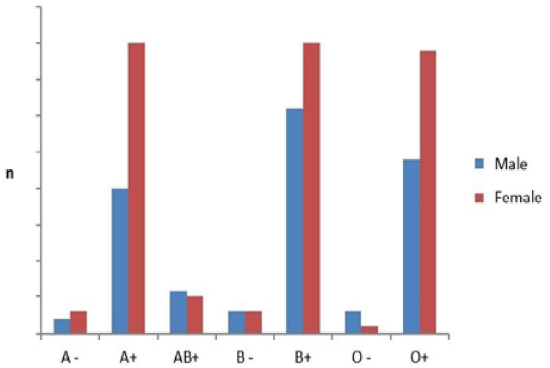

Figure:1 Distribution of Blood Types among Males and Females
(p=0.749)

Figure 1 shows blood type B^+ was the most prevalent in males 31 (34.8%) while in females, A^+ and B^+ 40 (30.5%) was trailed by O^+ 24 (27%) in males and 39 (29.8%) in females. The least common blood groups

in males were AB^+ 6 (6.7%), O^- 3 (3.4%), B^- 3 (3.4%), and A^- 2 (2.3%) respectively, while in females, these were AB^+ 5 (3.8%), A^- and B^- 3 (2.3%) and O^- 1 (0.8%). In this study, the prevalence of the distribution of Rh positive and Rh negative were 205 (93.2%) and 15 (6.8%) respectively. Gender difference showed 124 (94.7%) Rh positivity in females and 81 (91%) in males, and Rh negative 8 (9%) in males and 7 (5.3%) in females. According to ethnicity, the most prevalent blood group in Others was B^+ 8 (38.1%), A^+ 6 (28.6%) and O^+ 7 (33.3%) while in Sindhis, A^+ 26 (31.7%), O^+ 25 (30.5%), and B^+ 19 (23.2%) were the most prevalent.

The most common blood group in Mohajirs was B^+ with 36 (36.4%) as shown in Table1.

Table 1: Frequency of Blood Group Types in Different Ethnicities

Ethnicity	A+	B+	O+	Others**	Total
Mohajir	26	36	26	11	99
Sindhi	26	19	25	12	82
Punjabi	2	8	5	3	18
Others*	6	8	7	0	21
Total	60	71	63	26	220

$\chi^2 = 11.82$, df = 9, p-value = 0.224 *Others (Baloch, Memon, Pushtoon, Saraiki) **Others (A-, AB+, B-, O-)

Table 2 shows the association of Covid-19 with all the blood groups. Among 220 students, 18 (8.2%) screened out to be Covid-19 positive. Rh positive blood type showed more susceptibility than the negative Rh blood group type.

Table 2: Association of Blood Group Types with Susceptibility to Covid-19

	Blood Group Types					
Covid 19	A+	B+	O+	Others**	Total	p-value*
Positive	04	11	02	01	18	
Negative	56	60	61	25	202	0.046
Total	60	71	63	26	220	

**Chi Square Test*
*** A-, B-, O-, AB+*

In Covid positive cases, B^+ blood group was associated significantly (p=0.006) with Covid-19 at 11 (61%), followed by A^+ 4 (22%), and O^+ 2 (11%); while AB^+ was the least afflicted with only 1 (6%) case as shown in figure 2.

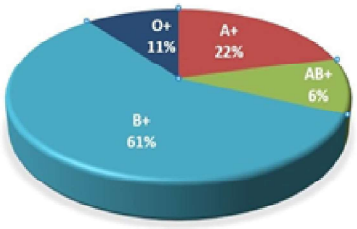

Figure 2: Susceptibility of Covid-19 positive cases in different blood groups (n=18)

DISCUSSION

Blood grouping is considered to be an important field of medical research due to its association with various pathologies like hypertension, diabetes, cardiovascular disorders, and carcinomas. The inheritance of agglutinogens A, B, both or neither on the surface of erythrocytes constitutes the ABO blood group system[16,17].

In our study, 40.5% participants were male and 59.5 % were female. In this study, 'B' was found to be the most frequent blood group at 35%. Ilyas et al from Punjab also found the same results, showing B with 35.6% being the most frequent blood group[18]. Another study conducted in Nowshera showed blood group B (32%) as the most prevalent group among all[19]. In contrast, the study conducted in Karachi by Naila Parveen[20] showed O blood type as the most prevalent. In male and female prevalence of blood groups, blood type B was highly prevalent, followed by O, A, and AB. Comparable results were found in a study done in Punjab[18] with most prevalent blood group as B followed by O, A, and AB. This is unlike the study conducted by Zahra et al[16] which showed blood type O was the commonest blood group in females followed by A and B and in males, A followed by blood types O, B, and AB.

Exploration of blood group distribution in Pakistani population reveals that the frequency of different blood types is B 36%, O 33%, A 21%, and AB 9%[20,21]. A study done in Khyberpakhtunkhuwa[20] shows frequency of different blood groups to be A>O>B>AB, whereas a study done in Punjab shows O>B>A>AB[6]. Among all studies, AB Blood group is found to be the least frequent blood group[6,7,16,18,20].

In our study, Rh positive and Rh negative frequency was found as 93.2% Rh positive and 6.8% Rh negative and similar results were found in studies conducted in Pakistan and India[22,23].

In our study, according to ethnicity, blood group B was found to be common in Mohajirs and Punjabis. Another study conducted in Karachi showed similar results for these ethinicities[24]. In Sindhi population, O blood type was found to be the most prevalent blood group at approximately 13 %. A study conducted in Pakistan by Ali N found B to be the frequent group in Arains and blood group O as prevalent (36.5 %) in Sindhi population[6].

Regarding Covid-19 susceptibility, our study revealed that positive Rhesus blood groups possess greater risk of infection rates compared to Rh negative blood groups. This is in contrast to the study conducted by Fawad et al but in line with the study by Zietz and

Tatnonetti who mentioned the association of Covid-19 with Rh positive blood significantly[25,26].

Our study also shows that blood group that is more prone to catch Covid-19 is blood group B. This is in contrast to the study conducted in China by Qian et al and Li et al, which showed blood type A was likely to get it more, with a low percentage of carriers of O blood groups[1,27]. Our study is in line with Latz et al. and Zietz et al., who reported that carriers of blood type O are protected from SARS CoV-2 infections while individuals with blood group A are more vulnerable to this disease. It was revealed that individuals with blood type B and O and Anti A agglutinins, had less probability to be afflicted with Covid-19[26,28]. Our study also revealed that blood type O is the least likely to catch Covid-19 virus. Another study by Fawad et al from Peshawar also showed a significant greater percentage of individuals in Covid-19 group, who carried blood type-B than in the control group (35.9% and 31.9%, respectively; p=0.009)[25]. Our study is in line with the research study done by Zietz et al. and Fawad et al probably due to the representation of Asian population. Gerard et al. concluded the same for Anti-A antibody. It has been postulated that these antibodies have protective behaviour. This can clear the concept of less number of cases found in individuals with blood type O that contains both A and B antibodies. Same is the case for the persons with blood group-B, they also have Anti-A agglutinins[29].

Another possible reason is the involvement of the trans membranal spike (S) protein of SARS-CoV-2, which when coalesced with another protein ACE2, acts as cellular receptor for the virus. Depending upon phenotypes of ABO blood groups, our gastrointestinal and respiratory epithelium synthesize A, B agglutinogens, where SARS-CoV-2 also replicates. So the individuals having A, B antigens along with S proteins would be having reciprocal antibodies in them, it might be possible that the reciprocal antibodies in these individuals can prevent the S protein and ACE2 receptor combination and hence provide defense against Covid-19 viral infection[30]. Thus, the linkage between ABO types and Covid-19 infection can be predicted. For instance if the virus afflicted a person carrying blood type B with the respective antigen will be a greater risk factor with high chance of infectivity for an individual also carrying the blood type B or AB, other than the persons with blood type O or A. This can be the explanation of the finding in our study as B is the most abundant group in our study so is the highest number of Covid positive cases in the same blood group carrying persons. It is a single center study, comprising all major ethnicities as students in a private medical college belongs to different cities and ethnicities in our population, making the study strong. On the other hand, small sample size is considered as a limitation and hence further research is recommended.

CONCLUSION

Our study concluded that blood groups are different among ethnic population of Karachi. With consideration to Rh system, Rh +ve is dominant than Rh -ve in all ethnic groups. Individuals carrying Blood type B have a greater chance to be inflicted with the Covid-19 viral infection as compared to the individuals with blood groups A, O, and AB. O blood group is least likely to be infected due to anti B and anti-Agglutinins or antibodies protective behaviour.

The results of the study would help in categorization, management and vaccine prioritization for higher risk groups for Covid-19 infection according to the prevalent blood groups in different ethnicities. We suggest that there should be registration of every individual infected with Covid-19, for linkage of ABO blood group types with prevalence and mortality that could be beneficial in comprehension of pathophysiology of this novel virus. Another major implication is the option of convalescent plasma therapy for Covid-19 patient's treatment regime.

Informed consent: Informed consent was obtained from all the participants before the collection of demographical data, taking history, and physical examination.

Conflict of interest: The authors declare that they have no conflict of interest.

Authors' contribution: NT, SJ, SH worked on introduction, methodology and proofreading. SJ, NT, AS, SK worked on Data collection, interpretation and write-up of manuscript. SJ, NT conceived the idea, worked on discussion and proofreading. AS, AK worked on statistical measures using SPSS, worked on results and proofreading.

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