

Distribution pattern of ABO and Rhesus blood groups among different ethnic population of Karachi

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Abstract

Objective: To determine the distribution pattern of ABO and Rhesus blood groups among different ethnic populations in an urban centre.

Methods: The retrospective cross-sectional study was conducted at Kharadar General Hospital, Karachi, from May to Dec 2017, and comprised antenatal and walk-in individuals of different ethnic groups who were tested at the hospital's clinical laboratory. Blood groups typing was carried out using Slide Agglutination (antigen-antibody) method with antisera anti-A, anti-B, and anti-D. SPSS 16 was used for data analysis.

Results: Of the 3521 subjects, 1253(35.6%) had blood group O, 1167(33.1%) group B, 849(24.1%) group A and 252(7.2%) had group AB. Also, 3209(91.1%) were Rhesus-positive and 312(8.9%) Rhesus-negative. Blood group O-positive was predominant in Balochi 381(41%), Mohajir 197(36%), Sindhi 147(38%), Hindko 39(44%) and Seraiki14(43.8%) groups, while B-positive was common among Pathan 207(35%), Punjabi 116(35%), Kacchi 123(37%), Memon 79(37%) and Bengali 20(36%) groups.

Conclusion: O positive was the most common and AB negative was the least common blood groups among different ethnic populations of Karachi.

Keywords: Blood groups, ABO, Rhesus factor, Ethnic groups, Distribution pattern. (JPMA 69: 1474; 2019).doi:10.5455/JPMA.302438

Introduction

The ABO system was the first human blood group system, discovered in 1901.¹ Later, the fourth type AB was added in 1902.² Blood groups are classified into types A, B, AB and O in the ABO system. In 1941, the Rhesus (Rh) blood group system was defined having Rh-positive and Rh-negative streams based on the presence or absence of inherited antigenic substances, like proteins, carbohydrates, glycoproteins and glycolipids, on the surface of the red blood cells (RBCs).³

ABO and Rh blood group systems are important for safe blood transfusion and organ transplantation purposes. In addition, these two systems are well established in population genetic studies, population migration patterns, deciding forensics and disputed paternity issues.^{4,5} Moreover, studies have found associations between certain diseases and the ABO and Rh blood group systems.^{6,7}

The frequencies of ABO blood groups vary from one population to another, and time to time in the same region distribution of these blood groups is different in different races. The knowledge of distribution pattern of ABO and Rh blood groups at local and regional levels is very important in the effective management of blood

banks and safe blood transfusion services. Therefore, there was a need to determine the distribution pattern of ABO and Rh blood groups in different ethnic populations of Karachi.

Karachi ranks 6th among the 10 most populated cities of the world, with a population density of 14.9 million.⁸ Karachi has most diversified population and Kharadar General Hospital, located in the old city area, caters to nearly all representative ethnic groups. Previous studies⁹⁻¹⁵ on distribution pattern of blood groups in Pakistan did not report ethnicity in relation to blood groups distribution pattern. The current study was planned to determine the distribution pattern of ABO and Rh blood groups among different ethnic groups living in Karachi.

Subjects and Methods

The retrospective cross-sectional study was conducted at Kharadar General Hospital (KGH), Karachi, from May to Dec 2017, and comprised antenatal patients and walk-in male individuals of different ethnic groups who were tested at the hospital's clinical laboratory. The antenatal attendees were included because blood grouping services from the clinical laboratory was mostly availed by pregnant women who came on antenatal visits. After approval from the institutional review board, convenient sampling was employed to raise the sample and subjects from Balochi, Pathan, Mohajir, Sindhi, Kutchi, Punjabi, Memon, Hindko, Bengali and Seraiki ethnic groups were

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enrolled after taking consent.

Venous blood sample was collected from each participant through venepuncture, using 5ml disposable syringe which was emptied into the ethylenediaminetetraacetic acid (EDTA) (Purple top) Vacutainer tubes. Blood grouping of ABO and Rh typing were performed through conventional slide agglutination (antigen-antibody) method. Blood drops were placed on a cleaned tile at three places, then a drop of antiserum A, B and anti-D (Seraclone™[®] by Bio-Rad Laboratories, Inc. Germany) was added and mixed with each blood drop using plastic stirrer. Blood was mixed thoroughly with the antiserum and rocked gently for 1 minute to observe agglutination. In case of doubt, the test was confirmed by reverse grouping, using known group A and B cells.¹⁶

SPSS 16.0 was used for data analysis descriptive statistics, including frequencies and percentages of ABO and Rh blood groups, were calculated. Pearson's Chi-square test was used to see the correlation between gender and blood groups/types. $P < 0.05$ was considered statistically significant.

Results

Of the 3521 subjects, 3187(90.5%) were females and 334(9.5%) were males. Overall, 1253(35.6%) subjects had blood group O, 1167(33.1%) group B, 849(24.1%) group A and 252(7.2%) had group AB. Also, 3209(91.1%) were Rh-positive and 312(8.9%) Rh-negative (Table-1). There was

Table-1: Distribution of ABO and Rhesus factor (Rh) blood groups among study population (n=3521).

Rh Blood Group	ABO Blood Group				Total
	Type A	Type B	Type AB	Type O	
Rh Positive	763 (21.7)	1072 (30.4)	234 (6.7)	1140 (32.4)	3209 (91.1)
Rh Negative	86 (2.4)	95 (2.7)	18 (0.5)	113 (3.2)	312 (8.9)
Total	849 (24.1)	1167 (33.1)	252 (7.2)	1253 (35.6)	3521 (100.0)

Table-2: Distribution of ABO blood group among different ethnic groups in Karachi (n=3521).

Ethnic groups	ABO Blood Group				Total
	Type A - N (%)	Type B - N (%)	Type AB - N (%)	Type O - N (%)	
Balochi	216 (23.2)	283 (30.4)	52 (5.6)	381 (40.9)	932 (26.5)
Pathan	174 (29.1)	207 (34.7)	53 (8.9)	163 (27.3)	597 (17.0)
Mahajir	124 (22.5)	191 (34.7)	38 (6.9)	197 (35.8)	550 (15.6)
Sindhi	95 (24.6)	118 (30.6)	28 (7.3)	145 (37.6)	386 (11.0)
Kutchi/Khatri	72 (21.4)	123 (36.6)	24 (7.1)	117 (34.8)	336 (9.5)
Punjabi	71 (21.4)	116 (34.9)	36 (10.8)	109 (32.8)	332 (9.4)
Memon	52 (24.5)	79 (37.3)	12 (5.7)	69 (32.5)	212 (6.0)
Hindko/Hazara	22 (25.0)	21 (23.9)	6 (6.8)	39 (44.3)	88 (2.5)
Bengali	16 (28.6)	20 (35.7)	1 (1.8)	19 (33.9)	56 (1.6)
Seraiki	7 (21.9)	9 (28.1)	2 (6.2)	14 (43.8)	32 (0.9)
Total	849 (24.1)	1167 (33.1)	252 (7.2)	1253 (35.6)	3521 (100.0)

Table-3: Distribution of Rhesus factor (Rh) blood group among different ethnic groups in Karachi (n=3521).

Ethnic groups	Rh Positive N (%)	Rh Negative N (%)	Total N (%)
Balochi	858 (92.1)	74 (7.9)	932 (26.5)
Pathan	534 (89.4)	63 (10.6)	597 (17.0)
Mahajir	503 (91.5)	47 (8.5)	550 (15.6)
Sindhi	352 (91.2)	34 (8.8)	386 (11.0)
Kutchi/Khatri	292 (86.9)	44 (13.1)	336 (9.5)
Punjabi	304 (91.6)	28 (8.4)	332 (9.4)
Memon	202 (95.3)	10 (4.7)	212 (6.0)
Hindko/Hazara	78 (88.6)	10 (11.4)	88 (2.5)
Bengali	56 (100)	0 (0.0)	56 (1.6)
Seraiki	30 (93.7)	2 (6.3)	32 (0.9)
Total	3209 (91.1)	312 (8.9)	3521 (100.0)

no significant difference between male and female blood groups in ABO ($p=0.71$) and Rh ($p=0.61$) distribution patterns.

The biggest ethnic group was Balochi 932(26.5%), followed by Pathan 597(17%), Mohajir 550(15.6%), Sindhi 386(11%), Kutchi 336(9.5%), Punjabi 332(9.4%), Memon 212(6%) Hindko 88(2.5%), Bengali 56(1.6%) and Seraiki 32(0.9%). Blood group O-positive was predominant in Balochi 381(41%), Mohajir 197(36%), Sindhi 147(38%), Hindko 39(44%) and Seraiki 14(43.8%) groups, while B-positive was common among Pathan 207(35%), Punjabi

Table-4: Distribution of ABO blood group among different ethnic groups based on Rhesusfactor (Rh) blood group system (n=3521).

Ethnic groups (N)	Rhesus Blood Group	ABO Blood Group				Total
		Type A	Type B	Type AB	Type O	
Balochi (932)	Positive	201 (21.6)	259 (27.8)	50 (5.4)	348 (37.3)	858 (92.1)
	Negative	15 (1.6)	24 (2.6)	2 (0.2)	33 (3.5)	74 (7.9)
Pathan (597)	Positive	154 (25.8)	186 (31.2)	46 (7.7)	148 (24.8)	534 (89.4)
	Negative	20 (3.4)	21 (3.5)	7 (1.2)	15 (2.5)	63 (10.6)
Mahajir (550)	Positive	111 (20.2)	176 (32.0)	37 (6.7)	179 (32.5)	503 (91.5)
	Negative	13 (2.4)	15 (2.7)	1 (0.2)	18 (3.3)	47 (8.5)
Sindhi (386)	Positive	85 (22.0)	107 (27.7)	25 (6.5)	135 (34.9)	352 (91.2)
	Negative	10 (2.6)	11 (2.8)	3 (0.8)	10 (26.3)	34 (8.8)
Kutchi/ Khatri (336)	Positive	61 (18.2)	111 (33.0)	23 (6.8)	97 (28.8)	292 (86.9)
	Negative	11 (3.3)	12 (3.6)	1 (0.3)	20 (5.9)	44 (13.1)
Punjabi (332)	Positive	61 (18.4)	108 (32.5)	33 (9.9)	102 (30.7)	304 (91.6)
	Negative	10 (3.0)	8 (2.4)	3 (0.9)	7 (2.1)	28 (8.4)
Memon (212)	Positive	49 (23.1)	76 (35.8)	12 (5.7)	65 (30.7)	202 (95.3)
	Negative	3 (1.4)	3 (1.4)	0 (0.0)	4 (1.9)	10 (4.7)
Hindko/ Hazara (88)	Positive	19 (21.6)	21 (23.9)	5 (5.7)	33 (37.5)	78 (88.6)
	Negative	3 (3.4)	0 (0.0)	1 (1.1)	6 (6.8)	10 (11.4)
Bengali (56)	Positive	16 (28.6)	20 (35.7)	1 (1.8)	19 (33.9)	56 (100)
	Negative	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Seriaki (32)	Positive	6 (18.6)	8 (25.0)	2 (6.3)	14 (43.8)	30 (93.7)
	Negative	1 (3.1)	1 (3.1)	0 (0.0)	0 (0.0)	2 (6.3)
Total (3521)	Positive	763 (21.7)	1072 (30.4)	234 (6.6)	1140 (32.4)	3209 (91.1)
	Negative	86 (2.4)	95 (2.7)	18 (0.5)	113 (3.2)	312 (8.9)

116(35%), Kacchi 123(37%), Memon 79(37%) and Bengali 20(36%) groups (Table-2). Within the Balochi group, Rh-positive distribution was 858(92.1%) and Rh-negative 74(7.9%) (Table-3).

The ABO distribution, based on Rh blood group, among different ethnic groups was also significantly different ($p < 0.05$). The most common blood group was O-positive 1140(32.4%) and the least common was AB-negative 18(0.5%) (Table-4).

Discussion

Knowledge of blood group distribution pattern is essential for blood banks and hospitals for safe blood transfusion and organ transplantation services. Frequency distribution pattern of blood group ABO among different ethnic groups of Karachi was the main finding of the current study which revealed that blood group O was the most common, followed by group B, group A and the least common was group AB (O>B>A>AB). Rh blood group was positive in higher proportion (91%) and negative in lower proportion (9%) of the study population. Similar findings were reported by a study conducted in Lahore.⁹ Most of the studies conducted in different regions of Pakistan have reported contrasting findings as B>O>A>AB⁹⁻¹⁵ (Table-5).

A 1988 study¹² reported that in Karachi, ABO pattern was

B>O>A>AB. The current study has reported the pattern as O>B>A>AB. Karachi is considered to be mini-Pakistan because it is home to all communities that exist in Pakistan. Population influx in Karachi from less developed and trouble-hit areas of the country was very high in the last two decades. It might have impacted on distribution pattern of blood group ABO. Furthermore, this study had an adequate sample size of 3125 individuals compared to an earlier study¹² which reported blood group pattern of only 200 participants.

The major ethnic population of the city, such as Mohajir, Sindhi and Balochi, had similar distribution pattern of blood group ABO and the predominant was group O followed by group B, group A and then group AB (O>B>A>AB). Two other important ethnic groups of the city, Pathan and Punjabi, had contrasting finding, with the dominant blood group being B, followed by group O, group A and group AB (B>O>A>AB). Study has also reported that all ethnic groups had similar findings about AB, the least common blood group. Similar findings about AB have been reported from different cities of the country.⁹⁻¹⁵

Variation in distribution pattern of ABO blood group was also reported by different countries. Consistent to current findings O>B>A>AB has been reported by multiple studies from various countries.¹⁷⁻¹⁹ Contrasting results of

Table-5: Comparison of percentage of ABO and Rhesus factor (Rh) blood groups in different regions of Pakistan and other countries.

S. No	Regions of Pakistan	Type A	Type B	Type AB	Type O	Rh +ve	Rh -ve
1	Lahore (09)	24.2	31.9	8.4	35.5	NA	NA
2	Faisalabad (10)	23.3	38	9.9	28.7	89.1	10.9
3	Rawalpindi/ Islamabad (11)	24.2	34.3	10.1	31.3	91	9
4	Karachi (12)	23.5	36.5	10	30	93	7
5	Multan (13)	21.9	36.9	7.3	33.8	92.2	7.8
6	Peshawar (14)	31.2	31.7	10.1	27	92.5	7.5
7	Mardan (15)	24.8	28.0	19.4	27.9	94.3	5.7
Other Countries							
8	Nigeria (17)	19.7	22.8	3.0	54.5	96.7	3.4
9	India (18)	23.8	29.9	6.4	39.8	94.2	5.8
10	Saudi Arabia (19)	24.0	17.0	4.0	52.0	93.0	7.0
11	Bangladesh (20)	21.8	37.5	8.9	31.8	96.8	3.2
12	Iran (21)	37.2	17.9	7.8	37.1	91.1	8.9
13	Nepal (22)	34.0	29.0	4.0	32.5	96.7	3.3

blood group ABO distribution pattern to have also been reported by studies.²⁰⁻²² Higher proportion of Rh-negative blood was observed in the United States as 17%,²³ and Iran 10%.²⁴ In Pakistan, Rh-negative frequency has varied from 5.4% to 10.7%.²⁵ Gender-based variation in the distribution pattern of blood groups ABO and Rh was not significant in the current study. More than 90% participants were female, with the female-to-male ratio being 10:1. Therefore, gender-based independent ethnic distribution pattern of the blood groups was not analysed.

The main limitation of the current study was its use of convenient sampling which led to a predominance of antenatal visitors. Another limitation was unequal proportion or unequal sample size of the ethnic groups. It was because Balochi, Mahajir and Pathan individuals who live around KGH were usually the most frequent visitors to the study site. However, the study is significant especially for blood banks and local hospitals of the area providing blood transfusion services. The blood grouping study will help in efficient delivery of safe blood transfusion services to the communities, particularly during emergency situations like road traffic accidents (RTAs), natural disasters, and other health emergencies. Study findings will also encourage relevant authorities to frame better national blood transfusion policy.

Conclusion

O-positive was the most common and AB-negative was the least common blood group among different ethnic groups of Karachi. Blood grouping information may be vital for different stakeholders, including blood banks and hospitals. This information will help in timely availability of the required blood groups, particularly during emergency, for the different ethnic groups.

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Conflict of Interest: None.

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