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ORIGINAL RESEARCH

ABO and Rhesus Blood Group Distribution in Mogadishu, Somalia

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Purpose: Our aim in this study is to reveal the blood group distribution by investigating retrospectively the blood types of around 60 thousand patients and donors who applied to Mogadishu Somalia Turkey Recep Tayyip Erdogan Training and Research Hospital between 2018 and 2021.

Patients and Methods: The blood group data of 59,442 people were included in this study. 20,414 (34.35%) of the study's participants were female, 39,023 (65.65%) were male. The blood groups of participants were determined using the slide method and the gel column technique. The frequencies and percentages of O, A, B, AB and Rh blood groups were calculated.

Results: The frequencies of ABO blood group distribution indicated that blood group O and Rh+ were predominant in Mogadishu O group: 60.30%, A group: 26.50%, B group: 11.27%, AB group: 1.93%, Rh+ group: 96.49%, Rh− group: 3.43%.

Conclusion: This is the first study about blood group distribution in Mogadishu based on a large number of blood type tests and hospital data. The findings of our study can guide the blood center administrators make decisions concerning blood stocking and supply. This study can give an idea about how much fluctuations may occur in the frequency of blood group types in emigrant populations over many years.

Keywords: blood types, ABO, Rh, Mogadishu, Somalia

Introduction

Blood is the most tested, simple to obtain and most vital body fluid. A series number of glycoprotein and glycolipid antigens are found on the surface of human red blood cells. These antigens form the blood groups, the presence or absence of each different antigen on the erythrocyte surface determines the blood group type.[1] Austrian scientists Karl Landsteiner discovered blood groups A, B and O in 1901[2] and Decastello and Sturli found out AB blood group 1 years later in 1902. The genetic transmission of blood groups was also explained by Decastello and Sturli.[3] With the discovery of the Rhesus factor by Landsteiner and Weiner in 1940, all major blood group antigens were determined.[4] As a result of studies carried out in many research centers, different types of these surface antigens were found. According to The International Society of Blood Transfusion, there are more than 30 blood types and approximately 700 erythrocyte antigens.[1] In newborn hemolytic illness, blood transfusion, and tissue transplantation, the ABO and Rh blood group systems are extremely important.[5,6] A and B antigens are seen not only on the erythrocyte surface, but also in many tissues, including vascular endothelium, nerve receptors, epidermis, and mucous cells. HLA antigens and A and B antigens are the two most effective factors in tissue rejection.[7]

When the literature is searched, a few research about blood group distribution in Somalia is available. It is noteworthy that Sistonen et al conducted a blood group and genetic analysis named "Distribution of Blood Groups in the East African Somali Population"[8] in which 1026 people participated in 1987. Our study can be accepted as an update of Sistonen et al's study. The blood types of approximately 60.000 patients and donors who applied to Mogadishu Somalia

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Turkey Recep Tayyip Erdogan Training and Research Hospital between 2018 and 2021 were evaluated retrospectively in this study. The frequency and proportions of O, A, B, AB and Rh blood groups were calculated. The frequencies and proportions of all groups were also extracted by gender.

In Somalia, obstetric hemorrhages; traumas caused by terrorist attacks and traffic accidents; surgeries; chronic kidney disease; critical nutritional deficiencies; parasitosis and anemic patients are the main conditions that require blood transfusion. There is no central public or private institution that supplies blood supply nationwide in Somalia yet. Health institutions supply blood for these patients from their relatives. This method may be insufficient to supply for rare blood groups such as AB and O Rh negative. Our findings may guide the establishment of health policies on blood supply and blood stock planning of hospitals in Somalia. By establishing a public or private institution and reporting the daily blood stocks of the hospitals to this centre, The situation of blood stock can be determined for Mogadishu, this stock information can be shared with the blood center managers of the hospitals. In this way, any hospital can supply blood from other hospitals in case of emergency. In addition, for blood groups that may be difficult to supply, this center can establish a database that containing the information of people have rare blood groups. People can be encouraged to donate blood voluntarily and awareness of the importance of donating blood can be created in the public. Later, this situation can accept blood from healthy donor and deliver the blood and blood productions to hospitals.

Materials and Methods

This research is based on the retrospective analysis of blood groups of 59,442 people who applied to the Blood Center of Mogadishu Somalia Turkey Recep Tayyip Erdogan Training and Research Hospital between November 2018 and November 2021. The Hospital Blood Center, which prepares whole blood and blood products, is one of Somalia's most essential and well-tested centers.

The blood groups were determined using the slide method and the gel approach based on Yves Lapierre's red blood cell agglutination response. In the slide method, Anti-A, Anti-B and Anti-D serums containing monoclonal antibodies were mixed with whole blood that contain Ethylenediaminetetraacetic acid on the slide, and those with agglutination were accepted as positive and those without which were considered negative.[9] In the gel column technique; If there is agglutination after the application of anti-serum specific to groups, the Gel column retains the agglutinated red blood cells. If there is no agglutination, erythrocytes pass through the gel column. If erythrocytes were on the top of the gel, it was considered positive; if erythrocytes passed the gel and remained at the bottom, it was considered negative.[10]

Blood group data of 64,728 people were extracted from the laboratory module of the hospital data management system. The records of blood donors, all patients, and healthy people whose blood group typing is requested from hospital polyclinics, services, and intensive care units are accessible through this module. Raw data were converted to an excel file. Multiple blood group analyses of the same patient were evaluated and transformed into single data, so duplicate data were eliminated. Finally, the blood group data of 59,442 people were included in this study. The frequencies and proportions of each O, A, B, AB, Rh negative and Rh positive blood groups were calculated separately. Then, frequencies and proportions of O Rh+, O Rh−, A Rh+, A Rh−, B Rh+, B Rh−, AB Rh+ and AB Rh− were calculated. Additionally frequencies and percentages of each blood groups were calculated according to male and female sex. Excel and Spss 22 software were used to create descriptive and other statistics for all groups and subgroups. Chi-square correlation analysis was performed to show whether or not the difference between blood groups according to genders was statistically significant.

Results

After processing these data and eliminating duplicate records, the results of 59,442 participants were used in the study. 20,414 (34.35%) of the study's participants were female, while 39,023 (65.65%) were male. First, The frequencies and proportions of the O, A, B, and AB groups were calculated, respectively O Group:60.30%, A Group:26.50%, B Group:11.27%, AB Group:1.93%, (O>A>B>AB) (Table 1). The most prevalent blood group was group O, followed by group A, group B, group AB. The most prevalent blood group in men was group O 39.8%, followed by group A 17.39%, group B 7.56%, and group AB 1.32%. In women, the O group accounted for 20.92%; group A accounted for 9.11%, group B for 3.71%, and group AB for 0.61% (O>A>B>AB). Males outnumber females nearly two-fold. When

the percentages of blood groups are examined, the proportions of women's blood group are half of men's. This is owing to the small number of females in the population. Female and male subgroups have extremely similar intra-group blood group frequencies (Table 1).

Table 2 shows the frequency distributions of Rh groups. The percentage of people who are Rh positive is 96.49%, the rate of Rh negative is 3.51%. Women have the Rh positivity rate of 96.32%, which is similar to the general average. Women have the Rh negativity rate 3.68%. In men, the Rh positivity rate is 96.57%, whereas the Rh negativity rate is 3.43%.

Table 3 shows the distribution of the ABO group of combination with the Rh group. The O Rh positive blood group is the most common, accounting for 58.51% of men and 57.86% of women, 58.08% of total. The A Rh positive blood group is ranked second. Female, males and total frequencies are 25.67%, 25.72%, and 25.7%, respectively. B Rh positive blood group ranked third with 10.37%, 11.04%, and 10.81%. When the chi-square test with Spss 22 was applied to the numbers of male and female blood groups, the difference between male and female blood groups was statistically significant at the $p < 0.01$ statistical significance level (P: 0.002).

Discussion

Discovery of blood types and developments in transfusion medicine have made blood transfusion safe. Molecular Genetic studies reveal new blood groups, genetic differences or similarities between human populations are determined. We think that studies on blood group distribution are very necessary, especially in African countries. Because it is critical to design health policies and to direct them effectively in a geography where people's need for health services is too great and service provision is insufficient. Blood group prevalence studies on Somali are rare. Our study is the largest and only retrospective population study designed to find out blood group frequencies in Somalia. Mogadishu Somalia Turkey Recep Tayyip Erdogan Training and Research Hospital is one of the largest hospitals that accepts patients from all states and settlements of Somalia. This feature can give a rough idea that the results of the study may reflect blood group distribution across Somalia.

Table 1 ABO Blood Groups Frequencies and Proportions

Blood Groups	Women n: 20.419			Men n: 39.023			Total n: 59.442	
	Frequencies	Percentage (for Total) %	Percentage (for Women) %	Frequencies	Percentage (for Total) %	Percentage (for Men) %	Frequencies	Percentage %
O Group	12.433	20.92	60.89	23.410	39.38	59.99	35.843	60.30
A Group	5.416	9.11	26.52	10.336	17.39	26.49	15.752	26.50
B Group	2.207	3.71	10.81	4.491	7.56	11.51	6.698	11.27
AB Group	363	0.61	1.78	786	1.32	2.01	1.149	1.93
Total	20,419	34.35	100	39.023	65.65	100	59.442	100

Note: n: The number of people included in the study.

Table 2 Rh Blood Groups Frequencies and Proportions

Rhesus Groups	Women n: 20.419		Men n: 39.023		Total n: 59.442	
	Frequencies	Percentage %	Frequencies	Percentage %	Frequencies	Percentage %
Rh+	19.668	96.32	37.685	96.57	57.353	96.49
Rh−	751	3.68	1.338	3.43	2.089	3.51
Total	20.419	100.00	39.023	100.00	59.442	100.00

Note: n: The number of people included in the study.

Table 3 ABO Rh Blood Groups Frequencies and Proportions

Blood Groups	Women n: 20,419		Men n: 39,023		Total n: 59,442	
	Frequencies	Percentage %	Frequencies	Percentage %	Frequencies	Percentage %
O Rh+	11.948	58.51	22.578	57.86	34.526	58.08
O Rh−	485	2.38	832	2.13	1.317	2.22
A Rh+	5.241	25.67	10.037	25.72	15.278	25.70
A Rh−	175	0.86	299	0.77	474	0.80
B Rh+	2.118	10.37	4.309	11.04	6.427	10.81
B Rh−	89	0.44	182	0.47	271	0.46
AB Rh+	361	1.77	761	1.95	1.122	1.89
AB Rh−	2	0.01	25	0.06	27	0.05
Total	20.419	100	39.023	100	59.442	100
Pearson Chi-Square ($\chi 2$)=22.876 p: 0.002*						

Notes: n: The number of people included in the study. *p<0.01 denotes statistical significance level. It was determined that the difference between blood groups according to genders was statistically significant. Chi-square correlation analysis was performed from Spss 22 package software.

The studies conducted by Sistonen[8] in 1987 and Abshir[11] in 2020 are based on genetic researches in a smaller population. Since the genetic study conducted in the Ethiopian Somali region by Abibakar[12] in 2019 is ethnically similar to Somali population, it was used in comparison with our own study. In these 3 studies (Sistonen, Abshir, Abibakar) the frequencies were 58.28-60-50.10% for the O group, 26.81–22-26,90% for the A group, 13.06-14-15.20% for the B group, 1.85-4-5.1% for the AB group, −88-95.6% for the Rh positive group, −12-4.4% for the Rh negative group respectively. Our results are very similar in O, A, B, AB blood groups for the frequencies of blood groups conducted by Sistonen et al.[8] Rh positive and Rh negative frequencies were not clearly specified in the Sistonen study. When the Sistonen study is compared to our study, the O group shows a 2% increase while the B group shows a 2% drop. There is little difference between group A and group AB. These findings may indicate that blood group ratios do not remain constant throughout time (approximately 35 years), and that some blood groups may increase while others decline. It can be possible with further study to disclose that these changes fluctuate at regular intervals. İf there is fluctuation, for explaining the causes of these, medical and non-medical such as socio-economic, migration and climate studies in addition to genetics may be required.

There is a significant difference between the study of Abshir[11] and our study when the percentage rates of Rh groups are examined (Rh positive 88–96.49%, Rh negative 12–3.51%, respectively). No significant difference was observed between other blood groups (O group 60–60.3%, A group 22–26.5%, B group 14–11.27%, AB group 4–1.93%). The findings of Abibakar[11] in the Ethiopian Somali region are similar to the findings of our study, except for the O and AB groups, 50.1–60.3% for the O group and 5.1–1.93% for group AB. Other proportions are 26.9–26.5% for group A, 15.2–11.27% for group B, 95.6–96.49% for Rh positive, 4.4–3.51% for Rh negative respectively (Table 4).

When several studies from the Horn of Africa and other African countries in the literature are scanned, it is discovered that there is an order of O>A>B>AB among the percentages of the groups. (Table 5). The highest proportion belongs to group O, while the lowest belongs to group AB. When group B and AB are examined, our study is one of the studies with the lowest rate in African countries. In most studies, the percentages of Rh positive and Rh negative are relatively similar.[12–18]

Conclusion

This study revealed that the groups with the highest percentages are O Rh+ (58,08%), A Rh+ (25.7%), and the groups with the lowest ratio are A Rh−(0.80%), B Rh−(0.46%), AB Rh+(1.89%), AB Rh−(0.05%). The findings of this study can guide

Table 4 The Blood Group Studies on the Somalis

Study	Blood Group (%)					
Studies, (n), (Year), (Place)	**0 Group**	**A Group**	**B Group**	**AB Group**	**Rh+**	**Rh−**
Sistonen[8] (1026), (1987), (Mogadishu, Somalia)	58.28	26.81	13.06	1.85	?	?
Abshir A. Ali[11] (95) (2020) (North Eastern Somalia)	60	22	14	4	88	12
Abibakar S. ismail[12] (4614) (2019) (Ethiopia, Somali Region)	50.10	26.90	15.20	5.10	95.6	4.4
Our Study (59,442) (2021) (Mogadishu, Somalia)	60.30	26.50	11.27	1.93	96.49	3.51

Note: n: The number of people included in the study.

Table 5 Blood Group Proportions of Some Countries

Countries	Blood Groups (%)					
Studies, (n), (Year), (Place)	**0 Group**	**A Group**	**B Group**	**AB Group**	**Rh+**	**Rh−**
Our Study, (59,442, (2022) (Mogadishu, Somalia)	60.30	26.50	11.27	1.93	96.49	3.51
Jahanpour,[13] (1815), (2017) (Tanzania)	52	26	19	3	98	2
Apecu,[14] (23,504), (2016) (Uganda)	50.3	24.6	20.7	4.5	98	2
Doku,[15] (42,317), (2018) (Ghana)	50	24.3	20.7	5	93.2	6.2
Hamed,[16] (10,116), (2011) (Mauritania)	49.10	28.28	18.56	4.05	94.23	5.77
Ndoula,[17] (14,546), (2014) (Cameroon)	48.62	25.07	21.86	4.45	96.32	3.68
Legese,[18] (40,053), (2021) (Ethopia)	41.5	29.8	23.2	5.5	91.5	8.5

Note: n: The number of people included in the study.

the blood center administrators make decisions planning blood stocking and supply. Because O Rh+ and A Rh+ group are the most common blood group, they are the easiest to supply. A Rh−, B Rh−, AB Rh+, AB Rh− are rare blood groups. Although the need is low, there may be problematic in supply.

Since our study is conducted approximately after 35 years from the study by Sistonen et al it can be seen as an update on blood group distribution data. Despite slight differences from previous data, it is clear that certain groups increased (O group, +2%), others decreased (B group, −2%), while others remained relatively stable. It may be appropriate for researchers to update the blood group distribution of population by conducting new studies at regular intervals such as 30–50 years. Alternatively, blood group distribution of individuals can be processed digitally by institutional authorities and constantly updated blood group distribution information can be accessed.

Abbreviation

RH, rhesus factor.

Ethical Considerations and Consent for Publication

The ethics committee of the Mogadishu Somalia Turkey Recep Tayyip Erdogan Training and Research Hospital gave their clearance. The permit procedures and paperwork were completed, and the permit minutes were issued with the decision dated November 22. 2021, and the number MSTH/8131. The ethics committee does not request an informed consent form for retrospective studies. As an institutional policy, the hospital management considers the approval of the ethics committee to be sufficient for publication permission.

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Disclosure

The authors report no conflicts of interest in this work.

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