

Distributional Patterns of ABO Blood Grouping and Rhesus Factor: Retrospective Cross-Sectional Study in Somali Regional Blood Bank

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Abstract: Blood is the most important body fluid. It is responsible for the transportation of the most critical substance, oxygen. The human red blood cell membrane contains different types of antigens, called agglutinogens. These antigens are capable of inducing specific immune response which in turn results in the production of antibodies. From the thirty blood group system genes already identified, the most important blood group systems are the ABO and Rh. Frequency of the four main ABO blood groups vary throughout the world mainly due to differences in geographical location and ethnicity. The aim of this study was to describe the distributional patterns of ABO blood grouping and Rh factor in Somali Regional State. A retrospective cross-sectional study was conducted in the blood bank from January 1 to February 10, 2019. Sample of three years (2015 to 2017) data was collected purposively. Data collectors were oriented prior to data collection and the study tool was pre-tested for corrections if any. Data processing and descriptive data analysis was undertaken by employing Microsoft Excel 2013 and SPSS 20. Ethical clearance letter was obtained from the Somali Regional Health Bureau and it was presented to the study facility. Blood group O has the highest frequency, 2,310 (50.10%) followed by blood group A, 1,366 (29.60%); B 702 (15.20%) and AB 236 (5.10%). The overall Rhesus factor positivity and negativity was 4,410 (95.6%) and 204 (4.4%) respectively. Blood group O is the most frequent blood type among blood donors in Somali region. Then, followed by A, B, and AB blood types. Absolute majority of blood donors in the region have Rh positive gene in the surface of their RBCs. Contact details of blood donors with rare blood types should be retained for tracking in cases of emergency blood donation requests. Concerned bodies at different levels should use findings from this study for planning and blood bank management.

Keywords: Distributional Patterns, ABO Blood Grouping, Rh Factor, Somali Region

1. Introduction

Blood is the most important body fluid. It is responsible for the transportation/circulation of the most critical substance, oxygen and other important nutrients, enzymes and hormones all across the body. The human red blood cell (RBC) membrane contains different types of polysaccharide antigens, called agglutinogens [1]. The antigenic substances are capable of inducing a specific immune response and that specific response results in the production of cells termed as antibodies [2]. These antigens are genetically controlled and are inherited in early fetal life by Mendelian manner and remain the same till death [3]. International Society of Blood Transfusion has identified 30 blood group system genes.

The most important blood group systems are ABO (A, B & O) and Rhesus (Rh) [4]. This is mainly due to the vast majority of the population carrying pre-formed ABO antibodies; this is the only blood group system where if you lack the antigen you will make the corresponding antibody without deliberate immunization [5]. The genes of ABO & Rh (D) are located on chromosome 9 & 1 respectively. The ABO blood group system was discovered by Karl Landsteiner in 1901. It was the first blood group system to be discovered. Landsteiner had mixed the sera and red cells from his co-workers and discovered that they reacted in different ways. He named three groups A, B and O. In 1902 Decastello and Sturli discovered the additional AB phenotype [5]. The ABO blood group is determined by the

presence of A and B antigens on the surface of the red blood cells, and of anti -A or anti -B antibodies in the serum. Hence, the red blood cells of blood type A possess antigen A and the serum contains anti - B antibody. Similarly, blood type B has antigen B and anti - A antibody. Blood type AB contains both A and B antigens but no antibodies. Blood type O has no antigens but it contains both anti - A and anti - B antibodies. Anti -A and anti -B antibodies are usually IgM type (Immunoglobulin M), and not present in newborns, but appear in the first year of life [6].

The Rh blood groups are so named because one of the eight Rh antigens (agglutinin D), was originally identified in Rhesus monkeys. Later the same antigen was discovered in human beings. Most people are Rh+ (Rh positive), meaning that their RBCs carry the Rh antigen [5]. Rhesus antigens are most immunogenic. From the 49 Rh antigens identified, expression of D antigen is the most crucial.

It's very pivotal to determine the blood group of both donor and recipient before any blood transfusion [7]. The health and safety of both patients and donors is central in blood transfusions. This requires advanced production methods, strict procedures, stringent quality requirements and checks, regulations and monitoring during the administration. Every donation is tested, thereby minimizing the risk of blood-transferable infections through blood components [8]. If we were to randomly transfuse red cells to a group of people without ABO grouping either the donors or the recipients there is a high probability that some would receive ABO incompatible blood and potentially undergo an acute haemolytic transfusion reaction. As such it is of paramount importance that both the blood donor and blood component recipient are ABO grouped correctly and compatible blood components are transfused [5]. Since rhesus antigens are very immunogenic, its typing is also very crucial for safer blood transfusion. When D negative individuals encounter the D antigen they produce anti D which causes hemolytic transfusion reaction, or hemolytic disease of the newborn. For this reason, the status of Rh typing is determined in blood donors, recipients who receive blood transfusion, and in pregnant ladies [9].

Frequency of the four main ABO blood groups varies in the population throughout the world mainly due to differences in geographical location and ethnicity. In Caucasians in the United States, the distribution is 47% for group O, 41% for group A, 9% for group B and 3% for group AB. Among the African Americans, the distribution is 46% for group O, 27% for group A, 20% for group B and 7% for group AB. In the Orientals, the distribution of blood group is 36% for group O, 28% for group A, 23% for group B and 13% for group AB [10].

Ethiopia is a country with a great geographical as well as ethnic diversities. There are about 80 different ethnic groups in the country. Somali Regional State is one of the nine administrative regions in Ethiopia. The region is inhabited by ethnic Somali people whose pastoralist life style is still largely dominant. There is no known country wide studies on the distributional patterns of ABO blood grouping and Rh

typing except some studies in the highlands of the country. In this studies, the frequency of blood groups was O, A, B and AB respectively. Hence, the aim of this study is to describe the distributional patterns of ABO blood grouping and Rh factor in Somali Region for better blood transfusion services and blood bank management.

2. Materials and Methods

2.1. Study Setting

The study was undertaken in Somali Regional Blood Bank in the capital Jigjiga, eastern Ethiopia. This blood bank is the largest and only the very existing one in the region except emergency mini-blood banks in some health facilities. Therefore, it provides day to day services to needy individuals that are from all over the eleven zones of this region and perhaps, individuals from other regions of Ethiopia. As per the last Ethiopian housing and population census in 2007, the regional population can now be projected as 5,824,161 with 2.6% annual growth rate [11]. Since, the blood bank is in the regional capital, blood donors and subsequent recipients were expected to be good representatives for the region wide population.

2.2. Study Design and Period

A retrospective cross-sectional study was conducted in Somali Regional State Blood Bank from January 1 to February 10, 2019.

2.3. Sample Size and Sampling Procedure

All blood donors (volunteers & donors for replacement) who had donated blood and whose blood had passed transfusion legibility screening process from 2015 to 2017 were included in the study. Data of these three consecutive years was taken purposively because complete data were available unlike other years with incomplete data based on prior reviews of registration log books.

2.4. Data Collection and Quality Control

Data were collected using checklist with separate blood group categories. Frequency of each blood type in each year was recorded in an ordinary tally style with five records at once. Data collectors were oriented on how to collect data retrospectively from the available registers. Study tool was pre-tested before actual data collection commencement for any corrections or rearrangements.

2.5. Data Processing and Analysis

Data processing (entry, cleaning, editing, coding) was undertaken by using Microsoft Excel 2013. Then, data were exported to Statistical Software for Social Science (SPSS) version 20. Subsequent analysis of data was done by employing both Excel Spread Sheet and SPSS. Descriptive analysis of the distributional patterns of blood grouping and Rh factor was performed and depicted in frequency

distribution tables, graphs or charts.

2.6. Ethical Clearance

Ethical clearance was obtained from the Somali Regional Health Bureau (SRHB). Then, this was presented to the blood bank managing body to gain further permissions for data collection. To maintain confidentiality of information filled in checklists, basic identifiers of blood donors were not used. Rather, frequency of donor's blood types in each year was tallied and data were secured in a save area.

Table 1. Frequency of ABO blood types and Rhesus factor from 2015 to 2017, Somali Region, Ethiopia.

Blood Type	Rh Factor (D)		Blood Type Frequency	Percentage
	Positive	Negative		
A	1,310 (95.9%)	56 (4.1%)	1,366	29.60%
B	665 (94.7%)	37 (5.3%)	702	15.20%
AB	225 (95.3%)	11 (4.7%)	236	5.10%
O	2,210 (95.7%)	100 (4.3%)	2,310	50.10%
Total ABO Blood Collected (n)			4,614	100.00%

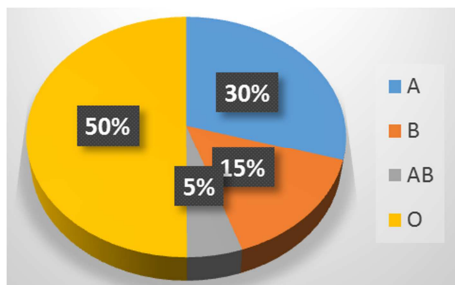


Figure 1. Blood type distribution from 2015 to 2017, Somali Region, Ethiopia.

Three years patterns/trends of blood group types and the Rh factor was plotted in figure 2. The highest frequency of O, A and B blood groups was recorded in 2015 and 2017 whereas, AB blood type frequency was higher in 2017 and 2015. There was no registered AB⁻ blood type in 2016 (figure 2).

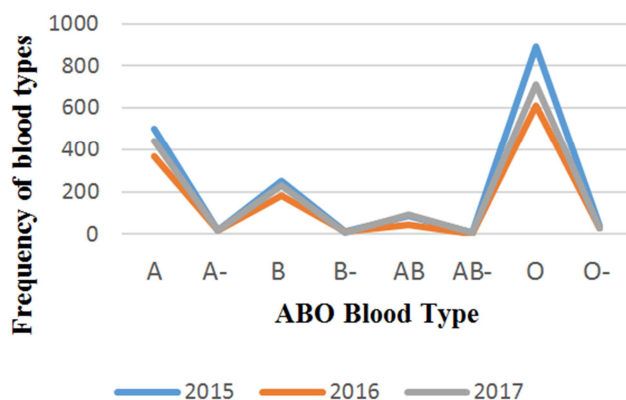


Figure 2. Patterns of ABO blood grouping and Rh factor from 2015 to 2017, Somali Region, Ethiopia.

4. Discussion

Evidence based information on the distribution of blood

3. Results

Data of 4,614 blood donors who had donated blood from 2015 to 2017 was analyzed. Blood group O has the highest frequency, 2,310 (50.10%) followed by blood group A, 1,366 (29.60%); B 702 (15.20%) and AB 236 (5.10%). The overall Rhesus factor positivity and negativity was 4,410 (95.6%) and 204 (4.4%) respectively.

types and Rh factor is very pivotal for routine blood donor selection, overall blood bank management and planning. Most importantly, concrete knowledge ABO blood groups and Rh factor is of crucial importance to track blood donor's of rare blood types (Rh negative individuals) and their subsequent recruitment for vital blood donations to their needy counterpart recipients.

In this study, the most common blood type was O; 2,310 (50.10%), followed by A; 1,366 (29.60%), B; 702 (15.20%) and AB; 236 (5.10%) blood types respectively. And the overall Rh positivity and negativity was 4,410 (95.6%) and 204 (4.4%). In this case, the frequency distribution of O blood type in Somali region is higher than that reported by other studies conducted in Ethiopia or elsewhere in the world. This can be mainly due to ethnicity or geographical differences among study populations and or study sample size variations.

Similarly, in studies from Australia, Britain and USA, blood group 'O' and 'A' were the commonest followed by B and AB [12 - 14]. In African continent, the most common phenotypic frequency order of blood group is; O>A>B>AB [15]. In Nigeria, different studies have also reported similar findings with blood group O having the highest frequency, followed by A, then B while AB has the lowest frequency [16 - 18]. Moreover, a study from Dilla University, Southern Ethiopia, found that the most prevalent blood group was type O (44.49 %) followed by A (26.32 %), B (26.32 %), and AB (2.87 %) [19]. And in a study conducted in Tigray region, northern Ethiopia, the most predominant blood phenotype was O (41.5%) followed by phenotype A (28%), Phenotype B (25%) and phenotype AB (5.5%). Additionally, the Rh positivity and negativity rate in this study was 91.2% and 8.8% respectively [20].

Differently, a study conducted in Jodhpur city, Indian State of Rajasthan, revealed that the commonest ABO blood group was B (36.4%), followed by O (31.7%), A (22.2%) and AB (9.4%) respectively. Rh Positive was 91.75% and Rh negative were 8.25% [21]. In another study conducted in

Bangladesh, distribution of blood group O was the highest (34.2%), but differently followed by blood group B (32.2%), A (24%) and AB (9.6%). In this study, percentage of Rhesus positive blood types was 96% and while Rhesus negative was 4% [22].

Limitations of the Study

As a retrospective survey, secondary data was collected and then, analyzed. In such cases, documents may not be very representative for the wider population or may lack key information about certain groups (marginalized groups). Moreover, a possible inter-gender blood group difference was not studied in this study. Hence, it can't clarify if ABO blood group frequency distribution differences exist between male and female blood donors.

5. Conclusion and Recommendation

Blood group O is the most frequent blood type among blood donors in Somali region. Then, followed by A, B, and AB blood types respectively. Absolute majority of blood donors in the region have Rh positive gene in the surface of their RBCs. Patterns of ABO blood groups and Rh factor throughout the three years depicts similar follow of blood type frequency but differences in the magnitude of yearly blood donors.

Somali regional blood bank services should retain contact details of individuals with rare blood types like AB and Rh negative because this can be crucial tracking means at times of emergency blood donation requests for such individuals. Furthermore, the SRHB in collaboration with the regional bank should use findings of this study for planning and ABO blood stock and distribution management.

Acronyms

ABO: A, B, & O Blood types; HDN: Hemolytic Disease of the New Born; Ig^M: Immunoglobulin M; RBC: Red Blood Cell; SRHB: Somali Regional Health Bureau; SPSS: Statistical Package for Social Science.

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