

Frequency and distribution of ABO and Rh Blood Group Antigens in Healthy Blood Donors at the Blood Bank of a Tertiary Care Hospital in Gandhinagar, Gujarat, India

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Abstract

Introduction: There are many blood group systems to classify red blood cells based on the presence of inherited antigens on their surface. Blood group antigens are inherited antigens and they already appear early in intrauterine life and remain constant through out life. Out of all antigens, two most important antigens are ABO and Rh antigens and they mostly found on RBCs surface and on platelets in blood. The human blood groups were first discovered by scientist Karl Landsteiner in 1901. ABO and RhD testing is the most frequently performed test in blood banking.

Aims and Objectives: To know the distribution frequency of other blood groups in healthy and adult blood donor, to compare this study data with other study data in other states of India and all over the world and to make documentation of a blood group data registry.

Materials and Method: Present study was conducted at Gujarat Medical Education and Research Society Medical College attached General Hospital, Gandhinagar, a tertiary care teaching Gujarat Government hospital. All blood donors were done counselling as per NACO guidelines and considered fit for blood donation were included in this study. Total 6853 blood donors were considered physically screened and declared fit and accepted for blood donation.

Results: Out of the total 6853 blood donors, 6508 (94.97%) were males and 345 (5.03%) were female and 6504 (94.9%) donors were of Rhesus 'D' positive and 349 (5.1%) were of Rhesus 'D' negative. In present study, blood group B was found to be the commonest blood group.

Conclusions: Female blood donors were very low because their haemoglobin level was below the required criteria and this needs to be increased by high quality of food and health status. The blood group of each and every person must be indicated on their driving licenses, aadhar card, PAN card and school/office identity cards. This study is most important for management of blood bank inventory and transfusion services to the needy patients.

Keywords: Blood group, Blood donors, Red blood cells, Replacement, Voluntary

Introduction

Human Blood is a type of body fluid. It delivers many important substances like nutrients and oxygen to the peripheral tissue and transports metabolic waste products away from those same cells. There are many cellular components in blood like red blood cells, white blood cells, platelets etc. In the human blood circulation main function of RBC is to transport fresh oxygen from the lungs to the peripheral tissues.⁽¹⁾

There are many blood group systems to classify red blood cells based on the presence of inherited antigens on their surface. This also helps to find out the paternity of a child in disputed cases.⁽²⁾

Blood group antigens are inherited antigens and they already appear early in intrauterine life and remain constant through out life.⁽³⁾ Till now many different antigens are discovered on RBC, but half of them are now recognized properly by the International Society of Blood Transfusion (ISBT). Out of which ABO and Rh antigens are most important.^(4,5) These antigens are mostly present on red cells and platelets in blood and on many organs like kidney, heart, pancreas, intestines and lung. ABH antigens are not fully developed at birth and it is not until 2-4 years of age that an individual gets

extremely developed antigens and after which they remain constant throughout human life.⁽⁶⁾

The human blood groups were first discovered by Austrian biologist and physician Karl Landsteiner in 1901.⁽⁷⁾ The ABO blood group genes are situated on 9th chromosome then fourth type AB was also found next year.⁽⁸⁾ Rh blood group system was the fourth system to be discovered and yet it is second most important blood group for blood transfusion view. The Rh genes are located at 1st chromosome. These two are clinically most important antigens.⁽⁹⁾ Out of many different blood group systems, the ABO and Rh blood group systems are of most importance in blood transfusion medicine and organ transplant.⁽¹⁰⁾

As per NACO and GSCBT guidelines, the main aim of blood transfusion services to provide adequate and safe blood to minimize transfusion transmitted infections and transfusion reactions. Human-to-human blood transfusion was first published by James Blundell in 1818.^(11,12) All human populations have same ABO and Rh blood group systems; but they may differ in the frequencies and distributions of specific types in different races, ethnic groups, and socio-economic groups or also amongst the different populations.^(13,14)

ABO and Rh blood group antigens are beneficial in compatibility test in blood transfusion practice and also helpful in resolving medico-legal issues and paternity disputes.⁽¹⁵⁾ ABO and RhD testing is the most frequently performed test in blood banking and forms the mainstay of pre-transfusion testing for incompatibility between a donor and recipient.

A regional donor data bank is of utmost importance in maintaining proper availability of specific blood group for required demand and for effective management of blood banks inventory, at a smaller local transfusion service or a regional or national transfusion service.^(16,17)

Aims and Objectives

To know the distribution frequency of different blood groups in healthy and adult blood donors, to compare this study data with other study data in other states of India and all over the world and to make documentation of a blood group data registry.

Materials and Method

Present study was conducted at Blood bank of a Gujarat Medical Education and Research Society Medical College attached General Hospital, Gandhinagar, Gujarat, India, a tertiary care teaching government hospital, over a period of two years from January 2015 to December 2016. The blood groups of all healthy blood donors of both sexes were studied.

All the voluntary and replacement healthy blood donors coming for blood donation to blood bank premises. All blood donors were done counselling as per NACO guidelines⁽¹⁸⁾ and considered fit for blood donation were included in this study. All necessary information regarding their personal details, marital status, demographic details, occupational details and past medical history was elicited. All blood donors having hemoglobin level more than 12.5 gm/dl, blood pressure was within normal limit, weight was more than 45 kilogram, having good mental health and also physically fit were selected. The donors were then asked to fill and sign the donor questionnaire form inclusive of informed consent form.

Total 6853 blood donors were considered medically fit and accepted for blood donation. After blood donation, ABO and Rh blood groupings were determined by tube agglutination method. Both forward cell grouping and reverse serum grouping were done according to the textbook of Dacie and Lewis⁽¹⁹⁾ and also follow the manufacturer's instruction available in kit. Standard antisera's like anti A, anti B, anti AB and Anti D were used after validation at blood bank. The antisera manufactured by Tulip Diagnostics Pvt. Ltd., Goa, India were used. Another antisera from Span diagnostics Pvt. Ltd., Surat, India were also used to cross check in doubtful cases. All these antisera used were monoclonal anti-A, monoclonal anti-B, monoclonal anti-AB and monoclonal anti-D (IgM). All weak D groups were considered as Rh positive.

Results

Table 1: Interpretation of Results of ABO and Rh Blood Grouping - Cell Grouping Method (++ = Agglutination. 00 = No agglutination)

Anti-A	Anti-B	Anti-AB	Saline	ABO Group
++	00	++	00	A
00	++	++	00	B
++	++	++	00	AB
00	00	00	00	O

Anti-D	Rh Group
++	D-Positive
00	D-Negative

Table 2: Interpretation of Results of ABO and Rh Blood Grouping - Serum Grouping Method (With Pooled RBCs) (+ = Agglutination. 0 = No agglutination. H = Haemolysis.)

A Cell	B Cell	O Cell	Blood Group
00	++/H	00	A
++/H	00	00	B
00	00	00	AB
++/H	++/H	00	O

Table 3: Distribution of all blood donors according to ABO blood group and gender

Type of ABO group	Rh Factor	Male (%)	Female (%)	Total (%)	Total (%)
"A"	Positive	1559 (22.75)	83 (1.21)	1642 (23.96)	1726 (25.19)
	Negative	80 (1.17)	4 (0.06)	84 (1.23)	
"B"	Positive	2234 (32.60)	101 (1.47)	2335 (34.07)	2443 (35.65)
	Negative	103 (1.50)	5 (0.07)	108 (1.57)	
"AB"	Positive	623 (9.1)	39 (0.57)	662 (9.67)	689 (10.05)
	Negative	26 (0.38)	1(0.01)	27 (0.39)	
"O"	Positive	1761 (25.70)	104 (1.52)	1865 (27.22)	1995 (29.11)
	Negative	122 (1.78)	8 (0.12)	130 (1.90)	
Total		6508 (94.97)	345 (5.03)	6853 (100)	6853 (100)

Table 4: Distribution of voluntary and replacement blood donors

	Voluntary Donors			Replacement Donors			Total
	Male	Female	Total	Male	Female	Total	
No. Of Donors	2886	330	3216	3622	15	3637	6853
Percentage	42.11	4.82	46.93	52.85	0.22	53.07	100

Comparison of frequency percentage of ABO and Rhesus blood groups in different regions of India and with different countries.

Comparison of frequency percentage of ABO and Rhesus blood groups in different regions of India and with different countries.

Table 5: Comparison of frequency and distribution of ABO and Rh blood groups in different regions of India and with different countries

Area	Area Location / Author	ABO Group				Rhesus Group	
		A	B	AB	O	Posi.	Neg.
Western India	Present Study	25.19	35.65	10.05	29.11	94.9	5.1
	Ahmedabad West Patel PA et al ⁽²⁰⁾	21.9	39.4	7.9	30.8	95.0	5.0
	Ahmedabad East Wadhwa MK et al ⁽²¹⁾	23.3	35.5	8.8	32.5	94.2	5.8
Northern India	Uttarakhand Parul Garg et al ⁽²²⁾	28.7	32.0	10.5	28.7	94.5	5.5
	Lucknow Chandra T et al ⁽²³⁾	21.7	39.8	9.3	29.1	95.7	4.3
	Amritsar Kaur H et al ⁽²⁴⁾	18.0	38.1	9.6	34.3	91.3	8.7
Central India	Maharashtra Loni Giri PA et al ⁽²⁵⁾	28.4	31.8	8.8	31.0	95.3	4.4
Eastern India	Durgapur Nag I et al ⁽²⁶⁾	23.9	33.6	7.7	34.8	94.7	5.3
Southern India	Shimoga-Malnad Girish CJ et al ⁽²⁷⁾	24.3	29.4	7.1	39.1	94.9	5.1
	Banglore Periyavan A et al ⁽²⁸⁾	23.8	30.0	6.4	39.8	94.2	5.8
Outside India	Pakistan Khattak ID et al ⁽²⁹⁾	27.9	32.4	10.6	29.1	90.1	9.9
	USA Mollison PL et al ⁽³⁰⁾	41.0	9.0	4.0	46.0	85.0	15.0
	Australia ⁽³¹⁾	38.0	10.0	3.0	49.0	NA	NA
	Saudi Arabia Bashwari LA et al ⁽³²⁾	24.0	17.0	4.0	52.0	93.0	7.0
	Nepal Pramanik T et al ⁽³³⁾	34.0	29.0	4.0	33.0	96.3	3.3

Out of the total 6853 blood donors that were enrolled in the present study, 6508 (94.97%) were males and 345 (5.03%) were female donors. Out of 6853 blood donors, 2443 (35.65%) were having blood group B, 1995 (29.11%) donors having blood group O, 1726 (25.19%) donors having blood group A and 689 (10.05%) donors having blood group AB.

Out of the total 6853 blood donors, 6504 (94.9%) donors were found to be Rhesus 'D' positive and the rest 349 (5.1%) donors were Rhesus 'D' negative. The occurrence of Rhesus 'D' negative was highest in blood group O and lowest in blood group AB; while, Rhesus 'D' positivity was highest in blood group B, followed by blood group O, A and AB respectively.

Discussion

The present study was done to determine the distribution and frequency of ABO and Rhesus blood group among healthy blood donor population attending blood bank of Gujarat Medical Education and Research Society Medical College attached General Hospital, Gandhinagar, Gujarat, India, a tertiary care teaching government hospital, over a period of two years from January 2015 to December 2016.

The present study show that majority of donors (94.97%) were males as compared to females which is comparable with other studies.^(20,25,27) The reason in India as being a developing country, and majority of females in the reproductive age group are anaemic and their haemoglobin level needs to be increased by improving their food quality and health status. There may also be lack of motivation. Hence, there is need to encourage female donors and their diet should be improved by their food quality and also supplemented with good nutrients.

The present study show, out of total 6853 blood donors, voluntary donors were 3216 (46.93%) and replacement donors were 3637 (53.07%) which is in contrast to study of Girish CJ et al⁽²⁷⁾ done at Shimoga Institute of Medical Sciences, Shivamogga where voluntary donations were 37.30%. So in our institute there are more number of voluntary donations so that immediate and safe blood can be provided to all patients in emergency without waiting for the replacement donors and also there is less risk of transmitting transfusion transmitted infections with voluntary donations.

Table 5 show that, in the present study, frequency and distribution of ABO and Rh blood group in the healthy blood donors in capital city of Gujarat State, Gandhinagar are compared with the similar type of studies done in other state of India and also outside India. Frequency of ABO blood groups of present study was compared to the studies done at Ahmedabad by Patel PA et al and Wadhwa MK et al,^(20,21) at Uttarakhand by Parul G et al,⁽²²⁾ at Lucknow by Chandra T et al,⁽²³⁾ at Amritsar by Kaur H et al,⁽²⁴⁾ and at Maharashtra by Giri PA et al.⁽²⁵⁾ In all these studies, most common ABO blood group was B, which was followed by O, A and AB respectively. On other hand, studies done at Durgapur by Nag I et al,⁽²⁶⁾ at Shimoga-Malnad by Girish CJ et al⁽²⁷⁾ and at Bangalore by Periyavan A et al⁽²⁸⁾ the commonest ABO blood group was 'O', which is in contrast to present study where B is the most common ABO blood group.

Outside India, in the study at Pakistan by Khattak ID et al,⁽²⁹⁾ the commonest ABO blood group was B which is similar to our study. While in other countries of the world, like in USA⁽³⁰⁾ and in Australia,⁽³¹⁾ and at Saudi Arabia by Bashwari LA⁽³²⁾ showed the frequency of ABO blood group O was highly frequent which is in contrast to our present study.

The study done at Nepal by Pramanik T et al⁽³³⁾ found that the most frequent ABO blood group was A, whereas in studies done in most parts of India and also in other countries the commonest blood group is either B or O.

Table 5 also show that, frequency of Rhesus blood groups of present study was 94.9% and 5.1% for Rh positive and Rh negative donors respectively, which is closely similar to all studies^(20,21,22,23,24,25,26,27,28,29,31,32,33) except in USA⁽³⁰⁾ where it is 85% and 15% respectively. Some of the factors which can effect overall distribution of ABO Rh blood group depends upon the donor selection and deferral which are unique to specific locations.^(34,35)

Knowledge of different blood groups and frequency of ABO and Rh type blood groups is most important for management of blood bank and patients and also be policy decisions regarding emergency and routine functioning of hospitals and blood banks. The blood group must be indicated on their all types of identity cards. This will also be of tremendous use in case of emergencies when urgent transfusion is required. It is also necessary to conduct similar type of well designed studies in other states of India in order to determine the ABO and Rh blood group frequencies in them.

Conclusion and Summary

1. Out of total 6853 selected blood donors, 6508 (94.97%) were males and 345 (5.03%) were female donors. Blood donation by the females was very low because of prevalence of anemia and their hemoglobin level needs to be increased by improving their food quality and health status.
2. Out of total 6853 selected blood donors, ABO blood group B was found to be most common with 2443 (35.65%) donors, which is followed by blood group O with 1995 (29.11%) donors, blood group A with 1726 (25.19%) donors and blood group AB with 689 (10.05%) donors respectively.
3. Out of total 6853 selected blood donors, 6504 (94.9%) donors were found to be Rhesus 'D' positive and 349 (5.1%) donors were Rhesus 'D' negative.
4. Out of total 6853 selected blood donors, 3216 (46.93%) were voluntary blood donors and 3637 (53.07%) were replacement blood donors.
5. The frequency distribution of ABO and Rh blood group always varies in regards to different region, ethnicity and also from one population to another.
6. The blood group of each and every person must be indicated on their driving licenses, aadhar card, PAN card and school/office identity cards.
7. This study is most important for management of blood bank and transfusion related services to the needy and poor patients.

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