

# ABO blood group phenotype in and around Delhi: A study from tertiary care hospital

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## Abstract

**Background:** ABO blood group shows marked geographical and racial variation. The study of regional ABO phenotype is extremely important for understanding the regional demand of rare blood groups and to tide over the massive demands in case of natural calamities or mass disaster.

**Methods:** A retrospective study was carried out at Department of Blood Bank and Transfusion Medicine, VMMC and Safdarjung Hospital, Delhi from January 2013 to May 2014 constituting a total of 42,456 donors including both voluntary and replacement donation. The blood group antigens were determined using electromagnetic technology and the frequency is expressed in percentage.

**Results:** B phenotype is most common phenotype constituting 39.84% of total donors, followed by O phenotype with 28.56%, A with 21.24% and AB with 10.56%. A total of 91.16% donors are Rh positive, while the rest are Rh negative.

**Conclusion:** The ABO phenotype of Delhi and nearby regions is different from the western countries, South India and other parts of Asia. Thus this study aids in constructing a regional ABO phenotype data register for meeting regional transfusion demands.

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## Introduction

Human blood groups were discovered in 1900 and since then a variety of styles of terminology has been used to denote them. In 1980 the International Society of Blood Transfusion (ISBT) established a Working Party (later to become a Committee) organized red cell antigens into blood group systems. Landsteiner first described ABO blood group system in 1900. Alfred Von Decastello and Adriano Sturli discovered the fourth type AB, in 1902<sup>[1]</sup> and since then many different blood group antigens have been described. The second type of blood group is rhesus system which is denoted as Rh positive and Rh negative depending on whether Rh antigen is present or absent on red cells. Although almost 400 blood group antigens have been reported, the ABO and Rh have been recognized as the major clinically significant blood group antigens. In blood transfusion practice, the ABO and Rh is the most important blood group system for blood group compatibility.<sup>[2]</sup> This is because A, B, and Rh D antigens are strongly immunogenic and upon stimulation elicit a strong antibody response and their alloantibodies can cause destruction of transfused red cells or induce hemolytic disease of newborn.<sup>[3]</sup> ABO antigens are also important in organ transplantation, resolving paternity disputes and for forensic purposes. Blood groups are known to have some association with diseases like duodenal ulcer, diabetes mellitus and urinary tract infection.

The ABO blood group system is considered to be safe and cost effective in most transfusion except in case of multiple transfusions where extensive cross matching is required even for minor antigen to prevent alloimmunization.<sup>[4]</sup>

ABO antigen is the integral part of cell membrane and has different biochemical composition despite similar basic antigen.<sup>[5]</sup> Blood group genes are inherited in a Mendelian manner and are mostly located on autosomes. Most of the blood group genes are expressed in a co-dominant manner. ABO blood group system is genetically determined. The particular alleles at specified gene locus in an individual constitute the genotype. Phenotype is the outward expression of the genotype and it shows a wide range

of variation across races and geographical boundaries. Generally, O blood group is the most common, while AB group is the least common in a population.

The antigenic profile of ABO blood group system in Indian population is quite different from Western countries and ABO antigenic profile is needed for proper match of demand and supply and to deal with emergency need in case of rare blood group.

A regional donor data bank is of utmost importance in maintaining proper availability of blood for regional demand and for effective management of blood banks inventory, at a smaller local transfusion service or a regional or national transfusion service.<sup>[3]</sup>

## Materials and Methods

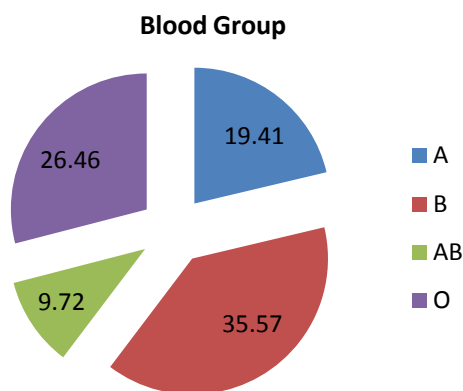
A retrospective study was carried out at Department of Blood Bank and Transfusion Medicine, VMMC and Safdarjung Hospital, Delhi from January 2013 to May 2014 constituting a total of 42,456 donors including both voluntary and replacement donation. The selected blood donors were medically fit and belonged to age group between 18-60 years. A questionnaire comprising of name, age, sex, address, contact number and previous and current medical history was filled by donors and confirmed by examination. Weight, blood pressure, pulse rate, height and hemoglobin were also recorded.

Most of the donors were from Delhi (India) and surrounding areas representing the north Indian population. The blood grouping was done by using fully automated and high output QWALYS 3 (DIAGAST FRANCE) that uses Erythromagnetic (EM) technology. The EM technology is based on magnetization of red blood cells.<sup>[6]</sup> ABO blood group determination was done concomitantly on the same machine by forward grouping by mixing antisera anti A, anti B and anti AB with donors RBC and results were confirmed by checking that corresponding antibodies are present in the test plasma using HEMALYS 1 A1, B which is a mixture of human red blood cells of known group A1 RH-1 or B RH -1. These controls used were sample of guaranteed phenotype of group A, B, AB and O.

**Ethical Issues:** Donors were informed that their blood will be tested for grouping and the details of their blood group may be used for transfusion and research purposes. Written consent was taken from donors regarding tests to be carried out for transfusion related diseases. The study was carried out within standard ethical norms.

## Result

The frequency of ABO and Rh blood groups in total study population of 42,456 was compared. The study comprised of 94.6% males and 5.4% females. A total of 91.16% donors were Rh positive and rest were Rh negative. B phenotype is most common phenotype constituting 39.69% of total donors, followed by O phenotype with 28.51%, A with 21.24% and AB with 10.56% (Table 1, Figure 1). The ABO blood phenotype percentage and Rh positivity rate among males and females was almost similar.



**Figure 1:** Pie chart showing different types of blood group and their percentage.

**Table 1:** ABO and Rh group system expressed in percentage (N = 42,456).

Phenotype	Rh Positive (%)	Rh negative (%)	Total
A	19.41	1.83	21.24
B	35.57	4.12	39.69
AB	9.72	0.84	10.56
O	26.46	2.05	28.51

## Discussion

Our study is in concordance with studies from other parts of India which have described a large number of male donors as compared to females. The leading reason for rejecting the female donors was low hemoglobin. In our country due to social taboo and cultural habits there is lack of motivation for blood donation among females. Hence, there is need to encourage female donors and their diet should be supplemented with good nutrients.

The average donor age recorded was 29.5 years. It is encouraging to notice that the predominant donor population is young.

There are few studies of ABO and Rh blood group prevalence among the various populations of India. Delhi being epicenter of health care for NCR and surrounding region, this study proves to be useful in formation of a data base that will provide information regarding availability of human blood in case of natural calamities or other disasters. The study is conducted in a tertiary care centre of repute and caters a large number of referred patients of nearby regions. Thus we have the exposure of all the surrounding regions providing a unique opportunity to study the ABO phenotypic profile.

The identification of genetic and environmental factors among racial and ethnic groups offers some insights into the observed epidemiological data related to blood groups.

Our study shows that the predominant blood group is B followed by O, A and AB. Other Indian studies from north India<sup>7</sup> also show a similar pattern while the overall prevalence of B blood group in world is low with O being the most common phenotype.<sup>[7,8,9]</sup> ABO phenotypic profile in north India is in sharp contrast as O blood group is found to be commonest in South India as found by Periyavan S, et al. (2010).<sup>[10]</sup> The frequency of Rh positivity found in our studies is in accordance with other studies like Calcutti RA, et al. (2003)<sup>11</sup> and Alam M (2005).<sup>[12]</sup> There are few studies which show a higher prevalence of Rh (D) Negative phenotype like Sharma S, et al. (2011)<sup>13</sup> Khan MS, et al. (2004).<sup>[14]</sup> Our study

shows ABO blood phenotype profile and Rh positivity rate among males and females was almost similar.

This pronounced variation demands a local blood bank data register for estimating the availability of compatible blood and evaluating the probability of hemolytic disease in the newborn. The present study adds to the existing knowledge pool regarding prevalence of various bloods group in Northern India and providing important information regarding rare blood phenotype in the region concerned.

### Conclusion

The ABO phenotype of Delhi and nearby regions is different from the western countries, South India and other parts of Asia. Thus this study aids in constructing a regional ABO phenotype data register for meeting regional transfusion demands.

Blood group distribution knowledge in addition to being helpful in transfusion medicine will help in clinical and forensic studies. Thus, the data provided will be helpful in delivering better health care facility and transfusion services in and around Delhi.

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### Competing Interests

None declared

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