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Trend of Blood Groups and Rh Factor in Last Decade within Indian Capital: Delhi

J. P. Prasad, Meena*, Madhu. E, Kanchan Ahuja, Subhash Kumar and Priya Bhatt

National Institute of Biologicals, Ministry of Health and Family welfare, Sector 62, Noida, Uttar Pradesh, India

Corresponding author

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A B S T R A C T

To determine the prevalence of different blood groups and Rh factors in a random population sample within Indian Capital: Delhi. Blood group and Rh factor determination was carried out by the antigen antibody agglutination test from 2004–2014 and encompassed 1550 subjects. The percentage of various blood groups were recorded as O^+ (31 %) & B^+(31 %) groups are dominant, followed by $A1^+$(21 %) and then by $A1B^+$(9%), while $A2^+$ (1 %), $A2B^+$ (1%), A1 Neg (1%), A2 Neg (0%), A1B neg (1%), B neg (2%), O neg (2%) and Bombay (0.001%) were rare in total population. The determination of the frequency of blood groups in the region would not only help in blood transfusion services, but also eliminate the risk of erythroblastosis foetalis in the neonates.

Introduction

Blood is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal. Blood is mostly liquid, with numerous cells and proteins suspended in it, making blood "thicker" than pure water. Blood is made up of red blood cells, white blood cells and platelets in liquid called plasma. Red blood cells (erythrocytes) have certain proteins on their surface, called antigens (Ganong, 1995). Also, your plasma contains antibodies which will attack certain antigens if they are present. There are various types of red blood cell antigens - the ABO and rhesus types are the most important. Blood carries several antigens within it, which form the basis of its reactivity (Novak, 1995) and hence it is not possible to mix the blood of all humans without initiating an immune reaction. Only the blood samples, which share the same antigenic identity, do not initiate an immune response and hence are termed as compatible. The utility of these antigens is not only for blood transfusion or organ transplantation, but have also been utilized in genetic research, anthropology and tracing of ancestral relation to human beings (Khurshid *et al.*, 1992). Blood is man's

complete and unchangeable identity, although almost 400 blood grouping antigens have been reported (Mohammad Shoaib Khan *et al.,* 2006), the ABO and Rh is recognized as the major blood group antigens. This system derives its importance from the fact that A and B are strongly antigenic and anti A and anti B occur naturally in the serum of persons lacking the corresponding antigen, these antibodies being capable of producing haemolysis *in vivo* (Talib, 1991). ABO blood group system was the first human blood group system, while Rhesus blood group system was the fourth system, out of 15 most important systems discovered and yet it is the second most important blood group from the point of view of transfusion (Khaliq *et al.,* 1984).

Karl Landsteiner was the first person to put forward the ABO blood group system in 1900 (Khan *et al.,* 2004; Shamim *et al.,* 2002). After 40 years (1940-1941), Landsteiner and Wiener discovered that blood group antigens could be recognized with specific antisera and a vast number of antigens have been detected on human blood cells, of which about 10–15% from well-defined systems and only 1–2% play a significant role in blood transfusion. These blood group antigens are divided into many blood group systems. Each of this system is inherited quite independently from all the other systems (Khurshid *et al.,* 1992; Mohammad Shoaib Khan *et al.,* 2006; Khaliq *et al.,* 1984; Onde and Kensee, 1995). Human blood antigens may either be erythrocytic, leukocytic or platelet related (Al-Bustan *et al.,* 2002).

The need for blood group prevalence studies is multipurpose, as besides their importance in evolution; their relation to disease and environment is being increasingly sought in modern medicine (Garrison *et al.,* 1976). Blood group antigens are not only important in relation to blood transfusion and organ transplantation, but also have been utilized in genetic research, anthropology and training ancestral relation of humans (Mohammad Shoaib Khan *et al.,* 2006).

Blood grouping has improved with the advent of monoclonal antibodies and the automation of tests. Although different advanced techniques, such as micro plate method, PCR based, FMC based typing, minisequencing analysis, fluorescent immunomicroplate technique, sandwich ELISA method, etc., for ABO genotyping are available, but manual method has its own significance not only in blood typing but also measuring its genotypic frequency by Hardy-Weinberg Law, with no additional costs in the areas with limited access to advance/automated techniques.

No comparative study is reported in literature regarding the population of Delhi with reference to distribution of ABO antigens in the region in last few years. The aim of the present study is to record the various blood groups among the population of Delhi, India, and also to compare the data with the population of other areas in India, as well as some other countries of the world (Pakistan), with a view to generate data with multipurpose future utilities for the health planners and also see the common trend of the prevalence of various blood groups.

Materials and Methods

A total of 1550 consecutive subjects, were screened for their blood groups.

Sample of blood was drawn from the antecubital vein of each subject in a Blood Bags with CPDA through Indian Red Cross Society (IRCS) and 5–6 ml transferred immediately to a sample collecting tube. Blood grouping (ABO) and Rhesus factors

(Rh), was done by the antigen antibody agglutination test. The ABO monoclonal reagents are in vitro culture supernatants of hybridized immunoglobulins secreting mouse cell-line. For determination of Rh factor, IgM + IgG monoclonal reagents were used.

Results and Discussion

Table 1 shows the prevalence of ABO blood groups in the studied population. The overall distribution of blood group in the total sample for groups B, A, O and AB, respectively are shown in figure 2. O^+ & B^+ groups are dominant, followed by $A1^+$ and then by $A1B^+$, while $A2^+$,$A2B^+$, A1 Neg, A2 Neg, A1B neg, B neg, O neg and Bombay were rare in total population.

The trend of blood group found in Delhi region is shown in figure 1.

Table 2 shows the prevalence of Phenotypes of blood groups in the studied population. The overall distribution of phenotypes in the total sample is shown in figure 3 & 4. R_1R_1, & R_1rare dominant, followed by R_1R_2, while R_2r, R_2R_2, R_1R_z R_0r, rr, r'r were rare in total population.

In the study, the relative frequency of the various blood groups (Figure 1 & 2), seems to be little deviate from those which have been recorded for studies on various segments of the Pakistani population (Mohammad Shoaib Khan *et al.*, 2006; Khan *et al.*, 2004). However, comparison with the data from the British and African populations (Talib, 1991; Khaliq *et al.*, 1984) reveals that there is an equal dominance of group B and O in the Indo-Pak sub-continent just like Delhi region, in contrast to only O group for the British and African populations. The least reported group, in all the populations, has been AB and A2. It has been reported (Shamim *et al.*, 2002), that in the populations of the United States and Asian group O is dominant, with AB being the rarest, while in Saudi Arabia the prevalence of blood group A is higher as compared to the Pakistani population, where the blood group B is more prevalent[4].

Table.1 Various blood groups (ABO and Rh) in the studied population (1550) from 2004 to 2014

Blood Group	Total	
	Numbers	Percentage (%)
O^+	488	31
B^+	474	31
$A1^+$	330	21
$A2^+$	12	1
$A1B^+$	140	9
$A2B^+$	16	1
A1 Neg	13	1
A2 Neg	2	0.001
A1B neg	8	1
B neg	28	2
O neg	37	2
Bombay	2	0.001
Total	1550	100

Table.2 Various blood groups phenotypes in the studied population (1550) from 2004 to 2014

Blood Group Phenotypes	Total	
	Numbers	Percentage (%)
R_1R_1	650	42
R_2r	70	5
R_2R_2	37	2
R_1r	471	30
R_1R_2	199	13
R_1R_z	10	1
R_0r	30	2
rr	78	5
r'r	5	0.003
Total	1550	100

Fig.1 Trend of various blood groups (ABO and Rh) in the studied population (1550) from 2004 to 2014

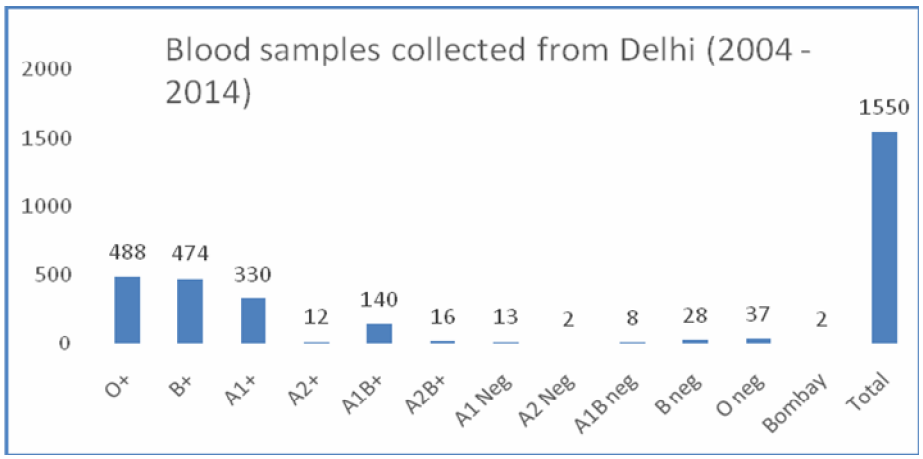


Fig.2 Percentage distribution of various blood groups in the studied population (1550)

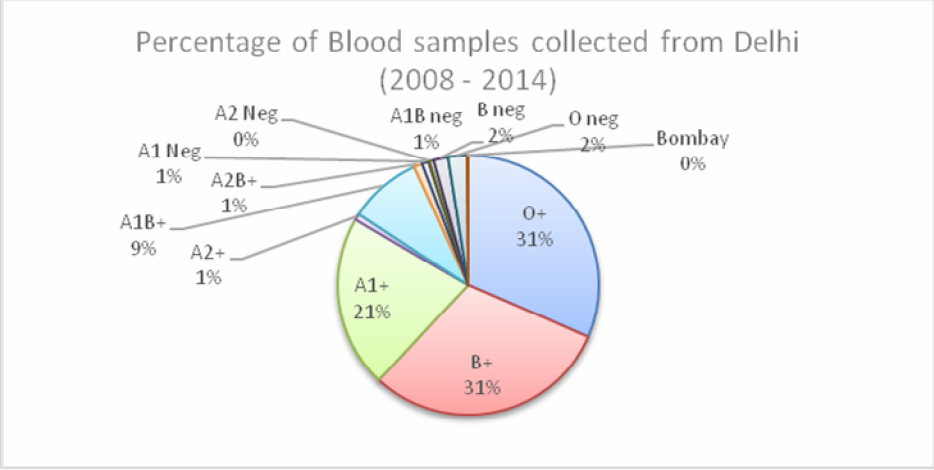


Fig.3 Phenotypes of various blood groups in the studied population (1550)

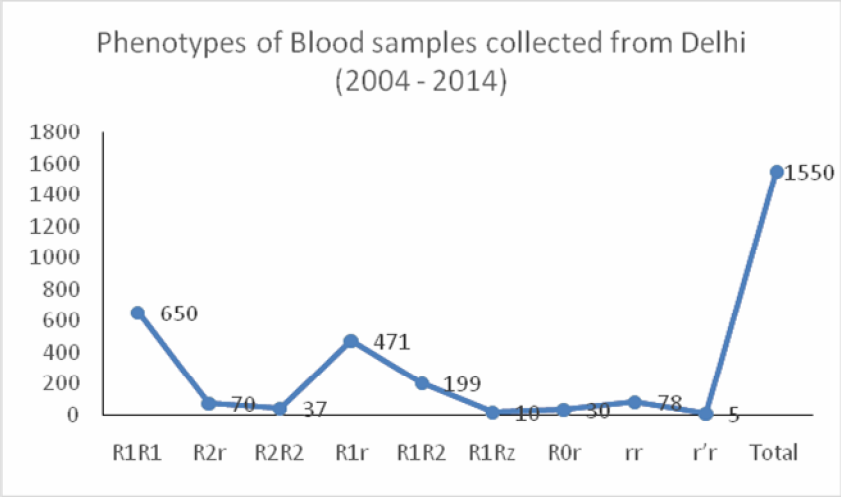
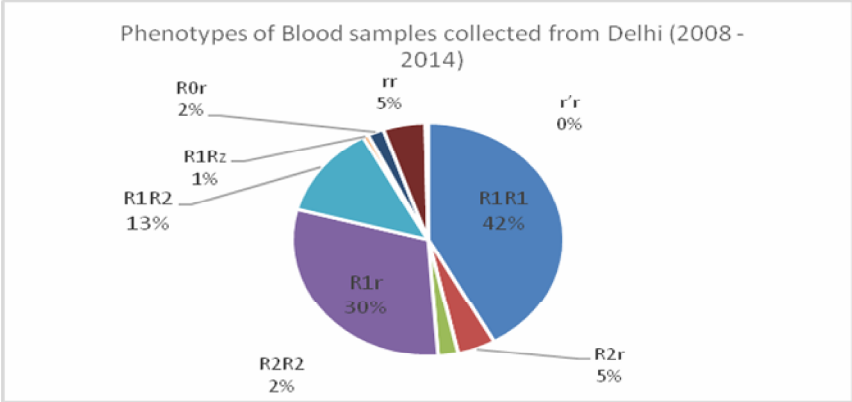


Fig.4 Percentage distribution of Phenotypes of various blood groups in studied population



This sharp difference among the blood groups distribution may be due to geographical variations, external environment and genetic factors involved (Khaliq et al., 1984; Onde and Kensee, 1995). Racial (genetic) and environmental factors have been reported to influence the frequency of various blood groups in studies carried in various societies, including Bangladesh and Latin America.4,8 In terms of Phenotypes R1R1, & R1rare dominant, followed by R1R2, while R2r, R2R2, R1Rz, R0r, rr, r'r were rare in total population studied in Delhi region (Figure 3 & 4).

The presence of Rh antibodies, the data from several studies in Delhi, Pakistani as well as certain African populations is compared, present study has shown comparatively the lowest percentage of Rh-negative cases, and follows the global trend of being significantly rarer than Rh-positive individuals. For the Rh (D) gene, 95.0% were Rh-positive while 5.0% were Rh-negative. The results obtained in the present study are in agreement with the results obtained by Mohammad Shoaib Khan *et al.* (2006) for a study carried out on the Pakistan & Afghan refugees, in which the percentage of Rh +ve and Rh -ve was 91.6% and 8.4 % respectively. An association with the blood groups with several diseases, specially cardiovascular diseases, which has been reported over the years (Shamim *et al.*,

2002; Garrison *et al.*, 1976; Cronenwett *et al.*, 1983; Green *et al.*, 1995) would make the data generated by the study, to be useful for health planners, while making efforts to face the future health challenges for the region. In conclusion, generation of a simple database of blood groups, not only provides data about the availability of human blood in case of regional calamities, but also serves as a forewarner of future burden of disease. Such studies need to be carried out at regional levels, wherever humanity resides.

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