

DISTRIBUTION OF PHENOTYPIC AND GENOTYPIC ABO AND RHESUS BLOOD GROUPS AMONG BANGLADESHI POPULATION

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Abstract

The present study is a retrospective analysis of allelic frequency of ABO and Rhesus (D) blood groups of donors attending the Department of Transfusion Medicine of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka. BIRDEM IS a 625 bed hospital, where patients and blood donors come from all parts of Bangladesh. A total of 1, 28,506 blood donors of both genders were included in the study over fourteen years from June 1995 to June 2009 for analysis. Blood group was determined by performing the both tube and slide method blood grouping method. The distribution of blood groups in our population was B > O > A > AB in Rh positive groups donors and O > B > A > AB among Rh negative donors. Blood group B was more common among the males (37.42%) while O was predominant among female donors (33.83%). On the other hand, blood group O negative was predominant in both genders (36.88%). In this study, Hardy-Weinberg equilibrium law was used to calculate the allelic frequency for ABO/ Rh system. Homozygous allelic frequency for Rh negative population was only 0.0007. Although phenotypically B group was dominant and AB was rare in our population, but according to Hardy-Weinberg equilibrium law the estimated allelic frequency of A (0.3694) and O (0.3040) showed higher frequency than B type (0.2300) in Bangladeshi population in both homozygous and heterozygous state. So, with increasing population of Bangladesh, this changing trend in estimated blood group in ABO system may play an important role in our genetic pattern.

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**Key words:** ABO and Rhesus blood group, phenotypic frequency, allelic or genotypic frequency

Introduction

The ABO and Rhesus (RhD) blood groups and the allelic frequency vary amongst the different population of the world. It varies from race to race, one country to another and even in different regions of a country.<sup>1-15</sup> This spectrum of difference may be attributed to genetic factors and natural selection which is affected mainly by traditions and habits namely exogamy and endogamy. Global frequency pattern of the type B blood allele is highest in central Asia and in few pockets of Africa but lowest in the America and Australia.<sup>2,15</sup> On the

other hand, equal dominance of group B and O is seen among the population of Indo-Pak subcontinent including Bangladesh and India.<sup>9,15-17</sup> Previous studies among Bangladeshi population reported that blood group B as the most common type followed by O and A type while group AB type as the least.<sup>16</sup> Limited studies among Bangladeshi population of Rajshahi, Jessor, Faridpur, Khulna and Nilphamari districts reported the frequency of blood group B from 32.58% to 35.20%.<sup>11,16</sup>

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**Table -1:** *Distribution of ABO and Rhesus blood groups of study population*

Gender	Number (%)	ABO Blood group				Rhesus blood group	
		A N (%)	B N (%)	O N (%)	AB N (%)	Rh D Positive N (%)	Rh D Negative N (%)
Male	69063 (53.74%)	18522 (26.8)	25682 (37.2)	18904 (27.4)	5955 (8.6)	67181 (97.3)	1882 (2.7)
Female	59443 (46.26%)	15768 (26.5)	18471 (31.1)	20158 (33.9)	5046 (8.5)	57993 (97.6)	1450 (2.4)
Total	1,28,506	34290 (26.7)	44153 (34.4)	39062 (30.4)	11001 (8.6)	125174 (97.4)	3332 (2.6)

In view of the above, we have analyzed the ABO blood group distribution of 1,28,506 Bangladeshi donors over 14 years period. Hardy-Weinberg equilibrium model was used to calculate the allelic frequency of ABO and Rhesus blood groups.

#### Materials and Method

This study was carried out in the Department of Transfusion Medicine of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka. Blood groups of 1,28,506 donors attending BIRDEM from June 1995 to June 2009 of both genders were analyzed. Forward grouping or cell typing was done on red blood cells after adding anti-A, anti-B and anti-AB antiserum (Biotec Laboratories, UK) and reverse grouping or serum typing was done on serum with known A, B and O cell (pool, freshly prepared). Presence of RhD antigen was determined by anti-D (Biotech Laboratories LTD, UK and Serological Lab, UK). Coomb's reagent (Serological Lab, UK) was used for the detection of Rhesus (Rh) weak D ( $D^u$ ). The data were analyzed for the frequency of ABO and Rhesus blood groups. The Hardy-Weinberg equilibrium was used to calculate the estimated allelic or genotypic frequency of ABO/Rh blood group system in our studied population.<sup>17</sup>

#### Results

A total of 1,28,506 donors were included over fourteen years from January 1995 to June 2009. Out of total 1,28,506 donors, 53.74% were male and 46.26% were female (Table -1). Amongst ABO blood group system, the most common group was B (34.4%) followed by

group O (30.4%), A (26.7%) and AB (8.6%). But the prevalence of group B was higher among the male compared to female (37.2% versus 31.1%) while for group O it was opposite (male 27.4% versus female 33.9%). The distribution of blood group A among male and female were almost equal and similar equal distribution of AB blood group was observed among male and female population. The overall frequency of RhD positive blood group was 97.4% with equal rates in male and female. The analysis of ABO blood group amongst RhD positive and negative groups showed that the O group was the most common (36.89%) among RhD negative people while in RhD positive people it was blood group B (34.56%). The detail distribution rhesus blood groups among people with different ABO blood groups and in RhD positive and negative people is shown in Table-2 and 3. There was higher prevalence of AB group in RhD negative people compared to that of positive cases. Table-4 showed the expected phenotypic and genotypic frequency respectively for the ABO and Rhesus blood group system of our studied population by Hardy-Weinberg equation. According to the Hardy-Weinberg equilibrium law, allelic frequency of RhD negative Bangladeshi homozygous (dd) population was only 0.0007 in our study.

**Table-2:** *Distribution of Rhesus blood groups among different ABO blood groups of study population*

ABO blood group system	Total Number	RhD system			
		Positive		Negative	
		N	(%)	N	(%)
A	34290	33428	(97.50)	862	(2.50)
B	44153	43255	(97.96)	898	(2.04)
O	39062	37833	(96.85)	1229	(3.15)
AB	11001	10658	(96.88)	343	(3.12)

**Table-3:** Distribution of ABO blood groups among Rhesus positive and negative population

Category	ABO Blood Group System			
	A N (%)	B N (%)	O N (%)	AB N (%)
<b>RhD Positive</b>				
Male = 67181	18048 (26.86)	25139 (37.42)	18214 (27.11)	5780 (8.61)
Female = 57993	15380 (26.52)	18116 (31.24)	19619 (33.83)	4878 (8.41)
Total = 125174	33428 (26.71)	43255 (34.56)	37833 (30.22)	10658 (8.51)
<b>RhD Negative</b>				
Male = 1882	474 (25.19)	543 (28.85)	690 (36.66)	175 (9.3)
Female = 1450	388 (26.76)	355 (24.48)	539 (37.17)	168 (11.59)
Total = 3332	862 (25.87)	898 (26.95)	1229 (36.89)	343 (10.29)

### Discussion

In our study population, blood group B was the predominant phenotype (34.56%) among ABO blood group system with dominant Rhesus D positivity (97.41%). Blood group AB was rare in both genders. Our study correlates with the studies done in India and

**Table-4:** Expected phenotypic and genotypic frequencies of the ABO and Rhesus blood group system according to Hardy –Weinberg equation.

ABO and Rhesus blood group system	Frequency
<b>Phenotypes</b>	
A	0.2668
B	0.3436
O	0.3040
AB	0.0856
RhD Positive	0.9741
RhD Negative	0.0259
<b>Genotype</b>	
AA (Ia Ia)	0.0725
AO (Ia Io)	0.2969
BB (Ib Ib)	0.0322
BO (Ib Io)	0.1978
AB (Ia Ib)	0.0966
OO (Io Io)	0.304
DD/Dd (Rh Positive)	0.9993
dd (Rh Negative)	0.0007

Note: d is amorph in allelic presentation

Pakistan.<sup>9,2</sup> The studies reported the frequency of blood group B in India and Pakistan as 32.50% and 34.00% respectively. Our study also correlates with the previous study done among Bangladeshi population, where B group was reported as 35.20% to 32.58%.<sup>11,16</sup> But a study conducted on haemato-oncology patients showed O as the predominant blood group.<sup>14</sup> Our study also differs with an Indian study, where distribution of ABO and RhD blood group among 150,536 blood donors in Christian Medical Collage Hospital, Vellore showed O blood group as the predominant (38.75%) type.<sup>9</sup> The prevalence of RhD positive rate correlates well with other reported studies from Bangladesh, India and Pakistan.

Our study revealed that estimated allelic frequency of A and O showed higher frequency than B type. So, with increasing population of Bangladesh, this changing trend in estimated blood group in ABO system may play an important role in our genetic pattern. In addition, further study may be done on different ethnic people of Bangladesh to see the distribution of rare and sub-groups of ABO and Rhesus system for medico-legal and clinical benefit.

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