

## ABO and Rhesus (D) Blood Group Distribution among Blood Donors in Rural South Haryana (Mewat-Region): A 5 Years Retrospective Study.

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Received: March 2018

Accepted: March 2018

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### ABSTRACT

**Background:** In India, geographical distribution of blood groups and Rhesus (D) factor varies across the country. The aim of this study is to examine the distribution of these groups among voluntary blood donors at a large academic medical centre; SHKM which is situated in a rural, most backward, least literate, remote pocket of south (Mewat-region) Haryana state in India. **Methods:** A retrospective study was conducted using 5 year data (August 2013–December 2017) from a regional blood bank in rural south (Mewat-region) Haryana of India. Records of 16,121 voluntary blood donors were reviewed. **Results:** The distribution of ABO blood group was; blood group O (29.69%); blood group A (22.37%); blood group B (37.72%) and blood group AB (10.22%). A significantly higher proportion of Rhesus (D) positive than Rhesus (D) negative in blood group A and AB (respective p-values are .018 and .089). **Conclusion:** The sequence of ABO distribution among the rural population in south (Mewat- region) Haryana of India is; B > O > A > AB, with males as the predominant donors.

**Keywords:** ABO, Rhesus (D), Blood groups, rural, remote, most backward area of Haryana state in India.

### INTRODUCTION

The discovery of the ABO blood groups by Austrian scientist Karl Landsteiner in 1900 was the greatest achievement in the history of blood transfusion medicine. He found three different blood types and he described them as A, B, and O blood groups. Alfred Von Decastello and Adrian Sturli discovered the fourth type AB in 1902.<sup>[1–3]</sup> Forty years later, both Landsteiner and Weiner discovered Rhesus (D) antigen.<sup>[4–6]</sup> The Landsteiner's discovery was a breakthrough in the history of blood transfusion medicine, as it opened the door to the birth of a wide spectrum of discoveries in the field of Immunoheamatology. To date about 700 red cell antigens have been recognized by International Society of Blood Transfusion.<sup>[7]</sup> These antigens are organized into 30 human blood group systems and

each person has a unique spectrum of blood groups with the exception of identical twins or triplets whose blood groups are exactly the same.<sup>[8,9]</sup> The most important human blood group systems for blood transfusion or transplantation are the ABO and Rhesus blood systems. Red blood cells contain a series of glycoproteins and glycolipids on their surface which constitutes the blood group antigens. The bombardment of the red blood cells with A and or B antigen occurs as a consequence of the action of glycosyltransferase enzymes that add specific sugars of conformation dependent epitopes along with the Rh (D) protein from D antigen. The production of these antigens is genetically controlled.

There are many blood group systems on the basis of different blood group antigens but only ABO and Rhesus system are important in clinical practice. ABO system consists of four main groups A, AB, B, and O which are determined on the basis of presence or absence of A and B antigens. These antigens are under the control of three allelic genes, A, B and O, situated on the long arm of chromosome 9q.<sup>[10]</sup> In Rhesus (D) system, blood groups are Rh-positive or Rh-negative on the basis of presence or absence of

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Rhesus D antigens on red cell surface. The Rhesus antigens are determined by three pairs of closely linked allelic genes located on chromosome one.<sup>[2]</sup>

All human populations share the same ABO and Rhesus blood group systems; although they differ in the frequencies and distributions of specific types in different races, ethnic groups, and socio-economic groups or amongst different populations.<sup>[11,12]</sup> There is no available literature on the frequency and distribution of the ABO blood group and Rhesus (D) blood group among the population living in this remote backward Mewat (south) region of Haryana. The knowledge of distribution of ABO and Rhesus (Rh) blood group is essential for effective management of blood bank inventory at the regional and national levels in the case of India.<sup>[13]</sup> This study reports the distribution of ABO and Rhesus blood groups among voluntary blood donors in Mewat region of Haryana in India.

Knowledge of the distribution of ABO and Rhesus blood groups is a significant element for effective management of inventory of blood banks and towards determination regarding recruitment of voluntary blood donors of a particular region; for facility of a local transfusion service, regional level, state level or national transfusion services. So, our study will enrich the national blood bank services with information critical for supply forecast and inventory management of blood banks.

It is therefore important and obvious to determine and have information regarding distribution of ABO and Rhesus blood group systems of different ethnic

groups in any population where blood transfusion services are being offered.

## MATERIALS AND METHODS

### Design and sample population

A retrospective study was conducted using 5 year data (August 2013–December 2017) from a regional blood bank in rural south (Mewat-region) Haryana of India. Records of 16,121 voluntary blood donors were reviewed. The donors were recruited mainly from the 4 tahsils of Mewat district (tahsils are taoru, nuh, firozpur jhirka, punahana), that have a total population of 10,89,263.<sup>[14]</sup>

Prior to donating blood the donors were first assessed for physical and health wellbeing. The assessment criteria required that the donors were: body weight >45 kg; haemoglobin levels, male 13.5–17.0 g/dl and female 12.5– 16 g/dl and a blood pressure of up to 160/90 mmHg were accepted. Only donors who satisfied these criteria were recruited.<sup>[15,16]</sup>

Blood grouping ABO and Rhesus was done by tube and gel card methods. Both forward (cell grouping) and reverse grouping (serum grouping) methods were used. The final blood group was confirmed only if both forward and reverse groups were identical. Donor's age, sex, location of blood donation, dates of donation and blood groups with Rh factors were tabulated in register book.

### Data and Analysis

The data is analysed by SPSS version-20 and used appropriate tests with 0.05 taken as level of significance for probability values (p-values).

**Table 1: Distribution of Blood Group (yearly)**

Blood group	2013	2014	2015	2016	2017	Total
A+	196	540	748	821	985	3290
A-	21	53	59	75	108	316
B+	319	920	1279	1341	1752	5611
B-	36	88	75	110	161	470
AB+	82	225	376	352	498	1533
AB-	3	25	32	27	28	115
O+	266	703	972	1049	1398	4388
O-	27	75	78	89	129	398

**Table 2: Interpretation of Table 1.**

Blood Group	Rh-D(+)	%	Rh-D(-)	%	Univariate Analysis CI OR	P-value
A	3290	22.19	316	24.32	1 (Reference)	.018
B	5611	37.85	470	36.18	.91(.80-1.030)	.116
AB	1533	10.34	115	8.85	1.19(.97-1.46)	.089
O	4388	29.60	398	30.63	.99(.88-1.12)	.90
TOTAL	14822	100	1299	100		

CI: confidential interval, OR: odd ratio, Significant P-value is <.05

**Table 3: Statics of Blood Group**

	A+	A-	B+	B-	AB+	AB-	O+	O-
Mean	658	63.2	1122.2	94	306.6	23	877.6	79.6
Std. Error of Mean	135.82452	14.22814	240.32507	20.6228	79.92785	5.12835	188.897	16.3083
Std. Deviation	303.71286	31.81509	537.3832	46.11399	158.5995	11.4673	422.388	36.4664
Variance	92241.5	1012.2	288780.7	2126.5	25153.8	131.5	178411	1329.8
Minimum	196	21	319	36	82	3	266	27
Maximum	985	108	1752	161	498	32	1398	129
Sum	3290	316	5611	470	1533	115	4388	398

**Table 4: Blood Group distribution (Combined Rh+ and Rh-)**

Blood Group	2013	2014	2015	2016	2017	Total	%
A	217	593	807	896	1093	3606	22.37
B	355	1008	1354	1451	1913	6081	37.72
AB	85	240	408	379	516	1648	10.22
O	293	778	1050	1138	1527	4786	29.69
Total						16121	100

**Table 5: Distribution of Rh+ and Rh-**

Blood group	Total donation	%
Rh(+)	14822	91.94
Rh(-)	1299	8.06
TOTAL	16121	100

## RESULTS

Twenty-three thousand five hundred four (16,121) blood donors were included in the study and were mainly male (99%). The distribution of ABO blood group was; blood group O (29.69%); blood group A (22.37%); blood group B (37.72%) and blood group AB (10.22%). The proportions of Rhesus (D) positive and Rhesus (D) negative were 91.94 and 8.06% respectively. A significantly higher proportion of Rhesus (D) positive than Rhesus (D) negative in blood group A and AB (respective p-values are .018 and .089).

## DISCUSSION

The findings of this study show that the blood group B occurs most frequently among the donors and blood group AB is the least common in Mewat region.

In our study Blood Group B is the commonest [Table 4] as previous a few studies conducted in India and Pakistan showed blood group B was the most predominant,<sup>[17-19]</sup> followed by blood group O, A and AB. While another study done in Nepal by Pramanik et al.<sup>[12]</sup> found the commonest blood group as group A, followed by blood group O, B and AB. However, in contrast to our study other studies in Australia by red cross society,<sup>[7]</sup> some studies of Africa,<sup>[20,21]</sup> Bangladesh, Western Europeans, the African-American and Caucasian population of America and in USA by Mollison PL et al.<sup>[5,6,12,22,23]</sup> have shown the commonest blood group was O, followed by A, B and AB, also consistent with our study findings. A study conducted elsewhere in Africa, this study unlikely did not determine the distribution of ABO and Rhesus group by ethnic group.<sup>[24]</sup> In all the studies cited and including our study, blood group AB is the least distributed among the population of the world.

This study reveals that Rhesus (D) negativity has the lowest distribution among the donors [Table 5] which is similar to other studies conducted. The identification of Rhesus blood system is important to prevent erythroblastosis fetalis. The frequency of Rh negativity, is less in Africans, Asians (mainly

Chinese) and American blacks compared to Caucasians.<sup>[25]</sup> In most parts of India, the incidence of Rhesus (D) negative blood group varies from 2 to 6%. About 5–11% of donors all over the world are detected as Rhesus (D) negative except in Britain and USA, where the distribution of Rhesus (D) negative is 15 and 17% respectively.<sup>[5,6]</sup> In this study approximately 99% donors are male; males are the predominant blood donors in the region.

The sequence of ABO distribution among the rural population of Mewat region is; B > O > A > AB and the frequency of Rhesus (D) negative is very low.

## CONCLUSION

The sequence of ABO distribution among the rural population in south (Mewat- region) Haryana of India is; B > O > A > AB, with males as the predominant donors. The frequency of Rhesus (D) negative is very low in this region.

### Acknowledgments

The authors would like to thank technicians Mr. Zakir H, Mr. Dan MD, Mr. Nadir H, Mr. Raheesh Kh, Mr. Manjit P, Mr. Prem C, Mr. Murari L, Mr. Deepak K, Mr. Radhe S and L.As Mr. Chhote L and Mr. Sunil Y of the SHKM BTS for their help in gathering data for this manuscript.

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**How to cite this article:** Singh S, Mishra SK, Kalhan S, Sharma P, Satarkar RN, Singh P, Singh NK. ABO and Rhesus (D) Blood Group Distribution among Blood Donors in Rural South Haryana (Mewat-Region): A 5 Years Retrospective Study. Ann. Int. Med. Den. Res. 2018; 4(3):PT30-PT33.

**Source of Support:** Nil, **Conflict of Interest:** None declared