

Distribution of ABO and Rh blood groups among various caste and ethnic groups: A cross-sectional study in a Teaching Hospital of Western Nepal

Sushma Thapa^{1*}, Arnab Gosh², Dilasma Ghartimagar¹, Sudeep Regmi¹, Adarsh Jhunjunwala³

¹Department of Pathology, Manipal College of Medical Sciences / Manipal Teaching Hospital, Pokhara, Nepal, ²Department of Pathology, Manipal Tata Medical College, Jamshedpur, India, ³Department of Pathology, Universal College of Medical Sciences, Bhairahawa, Nepal

ABSTRACT

Introduction: Red blood cells contain antigens on its membrane which are inherited according to Mendelian Law. Despite the identification of more than 400 red blood cell antigens, ABO and Rhesus blood group systems are clinically most significant. The current study aimed at determining the distribution of blood groups among different caste and ethnic groups of Western Nepal. **Methods:** A descriptive cross-sectional study conducted among individuals in the Blood Bank of Department of Pathology of a Teaching Hospital from January 2018 to July 2019. Ethical approval was taken from the Institutional Review Committee (Ref. 384). Convenient sampling was done. Data were entered in Microsoft Excel and analysed using Statistical Package for the Social Sciences version 21.0. Point estimate at 95% Confidence Interval was calculated along with frequency and proportion for binary data. **Results:** In ABO system, the frequency of O, A, B and AB blood groups were found to be 960(33.9%) (95% Confidence Interval= 32.15-35.64), 930(32.8%) (95% Confidence Interval= 31.11-34.57), 716(25.3%) (95% Confidence Interval= 23.68-26.88) and 226(8.0%) (95% Confidence Interval= 6.98-8.98) respectively. Rh positive was the dominant Rhesus blood group, 2758(97.4%) (95% Confidence Interval= 96.73-97.94). Blood group O was dominant in Brahmin, Bishwakarma, Gurung, Pariyar, Tamang, Terai Brahmin and Limbu. **Conclusions:** The frequency distribution pattern of ABO blood group was observed as blood group O>A>B>AB. Variation in the blood group distribution was observed in different ethnic groups.

Keywords: ABO system, blood group, ethnic groups, Rhesus system.

*Correspondence:

Dr. Sushma Thapa
Department of Pathology
Manipal College of Medical Sciences / Manipal
Teaching Hospital
Phulbari-11, Pokhara, Nepal
Email: sushmathp@hotmail.com
ORCID iD: 0000-0002-1303-9065

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INTRODUCTION

Blood grouping is based on antigenic property of red blood cells (RBC). The human RBC membrane contains 400 varieties of blood group antigens and the majorities are inherited in accordance with Mendelian Law.¹ The International Society for Blood Transfusion (ISBT) Working Committee catalogue currently lists antigens under 33 various blood group systems,² among which ABO and Rhesus (Rh) are the most clinically significant ones.

Blood grouping is one of the important tools for anthropological study of ethnic origin of people and for blood transfusion to avoid problems of mismatched transfusion.³ It has been observed that the frequencies of ABO and Rh blood groups differs in different parts of the world depending upon the ethnicity and races.⁴ In Nepal, there are 126 caste/ethnic groups reported in the National Census of Nepal 2011.⁵ There is variation in the frequency of distribution of ABO and Rh blood group systems among various caste/ethnic groups.¹

The purpose of the current study was to determine the frequency distribution of various blood groups among the different caste and

ethnic groups in a teaching hospital of Western Nepal.

METHODS

A descriptive cross-sectional study was conducted in the Blood Bank of the Department of Pathology, Manipal Teaching Hospital, a tertiary care centre from January 2018 to July 2019. Prior ethical approval from the Institutional Review Committee (IRC) was obtained with Reference No: MEMG/IRC/384/GA. All the cases with different caste and ethnic backgrounds whose blood samples were collected for blood group determination were included in the study. Convenient sampling was done and data was collected from the database present in the records of Blood Bank under the department of Pathology. Foreign nationals, newborns and those without demographic details were excluded from the study.

The sample size was calculated by using formula,

$$n = Z^2 \times p \times q / d^2$$

$$= (1.96)^2 \times 0.297 \times (1-0.297) / (0.05)^2$$

$$= 321$$

where, n= sample size, Z= 1.96 at 95% Confidence Interval, p= prevalence, 29.7% ⁶, q= 1- p, d= margin of error, 5%

Based on the above formula, the minimum sample size at a 95% confidence interval with 5% error was calculated to be 321. Blood grouping for ABO and Rh status was done by combined slide and tube agglutination method using commercially available antiserum manufactured by Tulip Diagnostics (P) limited, Goa, India. In slide method, a drop of each of the antiserum viz., anti-A, anti-B and anti-D was placed on three clean dry glass slides then, a drop of venous blood of the subject was mixed in each antiserum and mixed properly with the help of glass rods. The agglutination reaction was observed and confirmed under microscope. The collected data were entered in Microsoft Excel and then Statistical Package for Social Sciences version 25 software was used for data analysis. Point estimate at 95% Confidence Interval (CI) was calculated along with frequency and proportion for binary data.

RESULTS

The frequency distribution of ABO system among the studied sample in this study was found to be 960 (33.9%, CI=32.15-35.64), 930 (32.8%, CI=31.11-34.57), 716 (25.3%, CI=23.68-26.88) and 226 (8.0%, CI=6.98-8.98) in O, A, B and AB blood groups in descending order respectively.

In the current study, Rh positive 2758 (97.4%, CI=96.73-

97.94) was the dominant Rhesus blood group compared to Rh negative 74 (2.6%, CI=2.06-3.3).

Blood samples of 2832 Nepalese with different caste and ethnic backgrounds who underwent blood group determination were taken into consideration among which 2,390 (84.4%) were females and 442 (15.6%) were males with female to male ratio of 5.4:1. When both the ABO and Rh blood group systems were taken into a consideration, O positive blood group was found to be the most frequent blood group 932 (32.9%, CI=31.18-34.64) whereas AB negative 6 (0.2%, CI=0.04-0.38) was the rarest blood group in the present study. (Table 1)

Table 1: Distribution of ABO and Rh blood groups

ABO Blood Group	Positive n(%)	Rh blood group		95% Confidence Interval	Total n(%)	95% Confidence Interval
		95% Confidence Interval	Negative n(%)			
A	906(32.0)	30.27, 33.71	24(0.8)	0.51, 1.19	930(32.8)	31.11, 34.57
B	700(24.7)	23.13, 26.31	16(0.6)	0.29, 0.84	716(25.3)	23.68, 26.88
AB	220(7.8)	6.78, 8.75	6(0.2)	0.04, 0.38	226(8.0)	6.98, 8.98
O	932(32.9)	31.18, 34.64	28(1.0)	0.62, 1.35	960(33.9)	32.15, 35.64
Total	2758 (97.4)	96.73, 97.94	74(2.6)	2.06, 3.3	2832(100)	

Considering the distribution of ABO blood group among different ethnic groups, current study revealed that Blood group O was dominant in Brahmin, Bishwakarma, Gurung, Pariyar, Tamang, Bhujel, Shah, Terai Brahmin, Thakuri and Limbu ethnic groups, blood group A in Magar, Chhetri, Newar, Muslim, Rai, Thakali, Sarki, Yadav, Sherpa and Jalari and blood group B in Tharu, Lama and Kisan. Similarly, among the Rh blood group system, Rh+ve blood group were found to be dominant in Brahmin, Magar, Chhetri, Gurung, Bishwakarma and Newar ethnic groups while Rh-ve blood group were mostly seen in Brahmin, Bishwakarma, Magar, Chhetri and Newar ethnic groups.

In our study, the distribution of ABO and Rh blood group among various ethnic groups showed that O+ve blood group was the commonest blood group in Brahmin, Bishwakarma, Gurung, Pariyar and Tamang whereas A+ve blood group was dominant among Magar, Chhetri, Newar, Muslim, Rai, Sarki, Thakali. B+ve blood group was dominant in Lama, Kisan and Tharu. (Table 2)

Table 2: Distribution of ABO and Rh blood groups among various caste and ethnic groups

Caste / Ethnic group	ABO-Rh blood group								Total (n)
	A (n)		B (n)		AB (n)		O (n)		
	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve	
Brahmin	206	9	184	4	57	0	291	9	760
B.K.	91	6	76	4	24	1	99	5	306

Bhujel	5	0	7	1	2	0	12	0	27
Chhetri	162	4	107	4	28	1	134	1	441
Gurung	90	0	98	1	23	0	99	1	312
Jalari	2	0	1	0	0	0	0	0	3
Kisan	3	0	4	0	1	0	1	0	9
Kumal	4	0	0	0	0	0	4	0	8
Lama	1	0	6	0	1	0	0	0	8
Limbu	0	0	2	0	0	0	4	0	6
Magar	208	2	113	0	47	1	157	8	536
Majhi	1	0	0	0	1	0	2	0	4
Muslim	10	0	6	0	2	0	8	1	27
Newar	54	1	41	0	12	1	35	1	145
Pariyar	16	1	18	1	7	0	31	1	75
Rai	6	0	3	0	5	1	5	0	20
Sarki	5	0	3	0	1	0	0	0	9
Shah	4	0	6	0	0	0	10	0	20
Sherpa	2	0	0	0	0	0	0	0	2
Tamang	12	0	8	0	4	0	16	0	40
Terai Brahmin	2	0	3	1	2	1	9	0	18
Thakali	5	1	0	0	0	0	2	1	9
Thakuri	5	0	4	0	0	0	6	0	15
Tharu	8	0	9	0	3	0	4	0	24
Yadav	4	0	1	0	0	0	3	0	8
Total	906	24	700	16	220	6	932	280	2832

DISCUSSION

It has been observed that the percentage of blood group distribution differs in different parts of the world depending upon the ethnicity and races.⁴ In our study, blood group O was the dominant blood group 960 (33.9%) which was similar to the studies done in other parts of Nepal viz. Niroula et al.¹(34.8%), Shrestha et al.⁶ (35.1%), Sah et al.⁷ (34.8%), Pramanik et al.⁸ (32%), Pramanik et al.³ (36%) and Upadhyay-Dhungel et al.⁹ (34.87%). In contrast to our studies, Chapagain et al.,⁴ Pramanik et al.,¹⁰ Singh et al.,¹¹ and Humagain et al.,¹² found blood group A as the dominant blood group whereas in the study done by Jana et al.¹³ blood group B was found to be the dominant blood group with a frequency of 33.38% among all the 7610 blood donors included in their study.

The results of this study corroborates with the study done in the population in India (Multicentric study and West Bengal),^{14,15} Bangladesh,¹⁶ Thailand,¹⁷ Kenya,¹⁸ Britain¹⁹ and USA²⁰ but differs from the result of population of Pakistan.²¹ Blood group O was dominant in the present study similar to Asian, European, African and American population in contrast to the study done in Muslim population.²¹

The frequent pattern of blood group O>A>B>AB as observed in this study was also observed by different authors viz. Niroula et al.,¹ Shrestha et al.,⁶ Sah et al.,⁷ Pramanik et al.,⁸ and Pramanik et al.³ Similar pattern of blood group distribution was also observed by Xu et al. in Chinese population.²²

Considering distribution of ABO pattern among the Rhesus blood group system, it was observed that the frequency of ABO blood group pattern in both Rh +ve and Rh-ve subjects were O>A>B>AB which differs from the study done by Niroula et al.¹ in a population of 11,960 where the pattern in Rh +ve blood group distribution was O>A>B>AB and the pattern in Rh-ve blood group was O>B>A>AB. However, in both the studies, blood group O was the dominant and blood group AB was the least dominant blood group in both Rh+ve and Rh-ve subjects.

The frequency of Rh+ve blood group in this study was found to be 97.4% which is more or less similar to different studies conducted in Nepal ranging from 96.67% to 99.86%.^{3,6-8,10} In India, several studies reported different frequencies of Rh+ve blood group ranging from 87.1% to 94.53%⁶ whereas in Pakistani population,²³ it was ranging from 87.1% to 90% and in Bangladeshi population²⁴ it was 96.8%. The prevalence of Rh positive blood group has been reported as 85% in Caucasians, 95% in American blacks, 99% in Asians and 100% in African blacks.^{25,26}

Nepalese people are a conglomerate of diverse ethnic communities and its composition is the outcome of successive migration of the Tibeto-Burman group from the North and others from the South West. This population is a multi-ethnic population with a mixture of Indo-Aryan, Tibeto-Burman and other ethnic groups.³ In Nepal, there are 126 caste/ethnic groups reported in the National Census of Nepal 2011.⁵ From the result, it is evident that there is a variation in the frequency of distribution of ABO and Rh blood group systems among various caste and ethnic groups. In the current study, blood group O was dominant in Brahmins, Bishwakarma, Gurung, Pariyar, Tamang, Bhujel, Shah, Terai Brahmin, Thakuri and Limbu caste and ethnic groups, blood group A in Magar, Chhetri, Newar, Muslim, Rai, Thakali, Sarki, Yadav, Sherpa and Jalari whereas blood group B was dominant in Tharu, Lama and Kisan caste and ethnic groups. Similar to this study, Niroula et al.¹ found Blood group O as the dominant blood group in Brahmin, Bhujel, Bishwakarma, Shah, Gurung and Terai Brahmin, blood group A in Chhetri, Muslim and Rai ethnic groups and blood group B in Tharu. Similarly, Shrestha et al.⁶ reported blood group O as the dominant blood group in Brahmin, Chhetri, Tamang, Lama, Gurung, Sherpa, Terai Brahmin, Muslim and Yadav ethnicities whereas blood group A was reported as commonest in Newar, Magar, Limbu and Sanyasi ethnicities. Blood group B was reported as commonest in Tharu and Marwari ethnicities.

The Rh blood group was not equally distributed in all the caste and ethnic groups. In this study, some ethnic groups

such as Kisan, Kumal, Lama, Limbu, Majhi, Sarki, Shah, Sherpa, Tamang, Thakuri, Tharu and Yadav had only Rh+ve blood group whereas in the study done by Niroula et al.¹ Bhujel, Dhimal, Limbu, Gurung, Marwari, Magar, Musahar, Rajput, Sanyasi and Tamang ethnic groups had only Rh+ve people. In this study, Brahmin ethnic groups had more Rh-ve people as compared to any other ethnic groups whereas in one of the study done in eastern part of Nepal, Satar ethnic group had maximum number of Rh-ve people (11.5%) than other ethnic groups.¹

Considering the distribution of both the ABO and Rh blood groups among various caste and ethnic groups, our study revealed that O+ve blood group was the dominant blood group in Brahmin, Bishwakarma, Gurung, Pariyar and Tamang, A+ve blood group among Magar, Chhetri, Newar, Muslim, Rai, Sarki, Thakali and B+ve blood group in Lama, Kisan and Tharu. Similar to our study, Pramanik et al.³ also found O+ve blood group as the dominant blood group among the Brahmin and Gurung caste and ethnic groups, A+ve group among Chhetris and B+ve among Lama ethnic groups.

Some interesting results were found in our study. Among Rh-ve blood group, A-ve was dominant in Bishwakarma, Brahmin, Chhetri and Thakali caste and ethnic groups, B-ve was commonly found in Bhujel, Pariyar and Terai Brahmin and AB-ve was found only in Rai ethnic groups. O-ve blood group was dominant in Magar and Muslim ethnic groups.

The limitation of the present study is that it may not represent the whole population as this study is a hospital-based study.

CONCLUSIONS

In our study, amongst ABO blood group system, blood group O was the most common blood group followed by blood group A, blood group B and blood group AB which was similar to majority of the other national and international studies. Rhesus positive O, A and B blood groups were common in certain ethnic and caste groups which were similar to the other national studies. Brahmin ethnic groups had more Rh-ve people as compared to any other ethnic groups.

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AUTHORS CONTRIBUTION

ST collected data, designed the research, prepared the first draft of the manuscript, interpreted the data, prepared the manuscript, AG contributed in defining the intellectual content, designed the research, reviewed the manuscript, SR and AKJ performed statistical analysis and reviewed the manuscript, DGM contributed to prepare the draft of the manuscript. All authors read and approved the manuscript.

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