

Ethnic Variations of Blood Groups in a Medical College of Eastern Nepal

Niroula DR,¹ Jha MK,² Limbu P,³ Pokhre I,⁴ Yadav SK,⁵ Mukhopadhyay S¹

¹Department of Physiology
Nobel Medical College Teaching Hospital,
Biratnagar.

²Department of Physiology
Kathmandu University School of Medical Sciences
Dhulikhel, Kavre.

³Department of Physiology
Nepalese Army Institute of Medical Sciences,
Kathmandu.

⁴Department of Nursing
MS Ramaiah Institute of Nursing Education and
Research, Bangalore, India.

⁵Department of Biochemistry
Nobel Medical College Teaching Hospital,
Biratnagar.

Corresponding Author

Dilli Ram Niroula

Department of Physiology

Nobel Medical College Teaching Hospital,

Biratnagar.

E-mail: nirouladilliram@gmail.com

Citation

Niroula DR, Jha MK, Limbu P, Pokhre I, Yadav SK, Mukhopadhyay S. Ethnic variations of blood groups in a Medical College of Eastern Nepal. *Kathmandu Univ Med J.* 2018;61(1):18-22.

ABSTRACT

Background

Red blood cells contain antigens in its membrane which are inherited according to Mendelian law. ABO and Rhesus blood group systems are considered the most important blood group systems for clinical procedures, blood transfusion, organ transplantation, anthropological study and medico-legal purposes. Determination of ABO and Rhesus blood groups and its frequency distribution in a multiethnic country like Nepal is important for effective management of blood banks, safe blood transfusion services. The trend of blood groups and its ethnic distributions in the eastern part of Nepal is still unknown.

Objective

To find the distribution of blood groups among the subjects of different ethnic groups of eastern Nepal.

Method

A cross-sectional perspective study was carried out among the subjects visited in the laboratory of Nobel Medical College, Biratnagar, Nepal for a period of one year from August 1, 2015 to July 30, 2016.

Result

The 11,960 subjects were included in the present study, among which 5012 were males and 6948 were females. The study revealed that in ABO system, blood group distribution was 34.80% O, 28.66% A, 27.66% B and 8.89% AB. With regard to Rh blood group system, Rhesus +ve was 96.79% and Rhesus -ve was 3.21%. O blood group dominant ethnic groups were Brahmin, Bhujel, Biswakarma, Shah, Gurung, Marwari, Magar, Mahato, Mandal, Newar, Sanyasi, Tamang, Terai Brahmin and Yadav. Similarly, blood group A dominant ethnic groups were Chhetri, Dhimal, Limbu, Rai and Muslim. However, blood group B was dominant in ethnic groups, namely Biswakarma, Rajput, Satar and Tharu.

Conclusion

The frequency distribution pattern of ABO blood group was observed as O > A > B > AB and in Rhesus system, Rhesus +ve > Rhesus -ve. Variation in blood groups distribution was observed in various ethnic groups.

KEY WORDS

ABO system, Blood group, Eastern Nepal, Ethnic group, Rhesus system

INTRODUCTION

The human RBC membrane contains more than 600 surface antigens.¹ Among these antigens, 400 varieties are of blood group antigens and the majorities are inherited in accordance with Mendelian law.² Most of the blood group antigens developed from one allele or very closely linked genes collectively form blood group system.³ Chemically, blood group antigens are glycoproteins and glycolipids.⁴ ABO and Rhesus (Rh) blood group systems are most important for blood transfusion and genetic study. Three types of blood groups -A, B and O - of ABO blood group system was discovered by Austrian scientist Karl Landsteiner in 1900. AB blood group was discovered by Alfred Von Decastello and Adriano Sturli in 1902.⁵ Rh antigen was isolated by Karl Landsteiner and Wiener in 1941.^{6,7} Other blood group systems are MNS system, Kell system, Lutheran system, Duffy system, Kidd system etc.⁸

The trend of blood groups and its ethnic distributions in the eastern part of Nepal is still unknown. The purpose of the present study is to find the distribution of blood groups among the population of different ethnic groups of eastern Nepal.

METHODS

A cross-sectional perspective study was carried out among the subjects to find out ethnical variations in blood groups. After obtaining verbal consent from the subjects, the venous blood samples were collected from the subjects in the Central Laboratory of Nobel Medical College and Teaching Hospital, Biratnagar, Nepal. The date of commencement of the study was August 1, 2015 and ended July 30, 2016.

The blood group (both ABO and Rh systems) was determined by slide method using antigen-antibody agglutination test using standard kits. In slide method; a drop of each of the antiserum: anti-A, anti-B and anti-D was placed on 3 clean dry glass slides. A drop of venous blood of the subject was mixed in each antiserum and mixed properly with the help of glass rods. Agglutination reaction was observed and confirmed under microscope.

The collected data of blood groups was analyzed by using SPSS version 17 software.

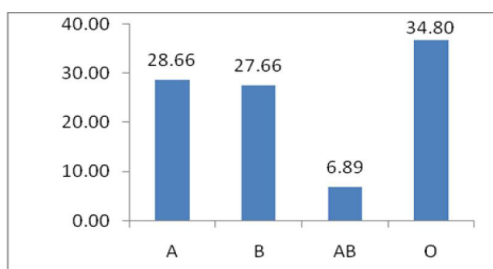


Figure 1. Distribution of ABO blood group system among the total subjects (n=11960).

RESULTS

The frequency distribution of different blood groups in ABO system of all the subjects (n=11960) is cited in figure 1.

Table 1 shows the frequency distribution of different blood groups in Rh system.

Table 1. Distribution of Rh-system among the total subjects (n=11960).

Types of Blood Group	Rh +ve	Rh -ve
Percentage (%)	96.79	3.21

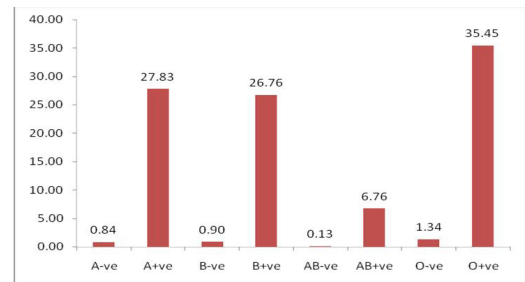


Figure 2. Frequency of ABO distribution in Rh positive and Rh negative subject (n=11960).

Table 2. ABO and Rh-systems variation in different Ethnical Groups.

Ethnic Group	Total (n)	A (%)	B (%)	AB (%)	O (%)	Rh +ve (%)	Rh -ve (%)
Bhujel	144	36.11	11.11	13.89	38.89	100	0
Biswa-Karma	236	20.34	35.59	1.69	42.37	98.31	1.69
Brahmin	2764	27.06	25.18	4.92	42.84	96.53	3.47
Chhetri	1556	33.68	24.68	8.48	33.16	95.37	4.63
Dhimal	60	73.33	13.33	0	13.33	100	0
Shah	728	20.88	33.52	8.79	36.81	95.60	4.40
Limbu	328	56.10	9.76	7.32	26.83	100	0
Gurung	104	30.77	19.23	7.69	42.31	100	0
Marwari	52	0	30.77	0	69.23	100	0
Magar	260	26.15	20	4.62	49.23	100	0
Mahato	116	20.69	24.14	6.90	48.28	96.55	3.45
Mandal	260	26.15	32.31	6.15	35.38	95.38	4.62
Musahar	24	33.33	33.33	16.67	16.67	100	0
Muslim	772	33.68	31.09	8.81	26.42	94.82	5.18
Newar	412	33.98	21.36	6.80	37.86	99.03	0.97
Pariyar	144	22.22	33.33	11.11	33.33	97.22	2.78
Rai	584	47.26	15.07	8.22	29.45	98.63	1.37
Rajbansi	360	24.44	35.56	4.44	35.56	98.89	1.11
Rajput	132	15.15	48.48	3.03	33.33	100	0
Sanyasi	80	20	35	5	40	100	0
Satar	104	26.92	38.46	0	34.62	88.46	11.54
Tamang	324	22.22	24.69	7.41	45.68	100	0
Tharu	916	24.02	38.43	8.30	29.26	99.13	0.87
Terai Brahmin	168	21.43	28.57	7.14	42.86	97.62	2.38
Yadav	744	19.35	33.87	5.38	41.40	91.94	8.06
Others	588	24.49	30.61	10.20	34.69	96.60	3.40

Table 3. ABO and Rh blood groups distribution reported in Nepal till date.

Authors	Types of Subject	Population	ABO System (%)				Rh System (%)	
			A	B	O	AB	+ve	- ve
Chapagain et al. ¹⁴	Jirel ethnic group	2093	55.05	14.72	21.64	8.60	99.86	0.14
Pramanik et al. ¹¹	Medical students	322	29	26	32	13	98.5	1.5
Sah et al. ¹⁰	School students	359	34.3	27.0	34.8	3.9	98.6	1.4
Upadhyay et al. ¹³	Medical students	2208	28.17	30.17	34.87	6.79	95.38	4.62
Humagain et al. ¹⁶	Hospital patients	553	29.1	25.7	28.2	17.0	90.2	9.8
Pramanik and Pramanik ¹⁷	Nepalese medical students	120	34.17	29.17	32.50	4.17	96.67	3.33
Shrestha et al. ⁹	Hospital patients	13568	29.7	27	35.1	8.2	97.3	2.7
Pramanik and Adhikari ¹²	Hospital patients	1310	29	27	36	9	99.92	0.08
Singh R ¹⁵	Blood donors	11934	32	26	29	12	-	-
Present Study	Subjects attended to Hospital	11960	28.66	27.66	34.8	6.89	96.79	3.21

Table 4. ABO and Rh blood groups distribution reported in outside the Nepal.

Country	Type of Blood Group (%)					
	A(%)	B(%)	O(%)	AB(%)	Rh+ve (%)	Rh-ve (%)
Present Study	28.66	27.66	34.80	6.89	96.79	3.21
Multicentric study in India ¹⁸	22.28	32.66	37.12	7.74	94.13	5.87
West Bengal India ¹⁹	23.9	33.6	34.8	7.7	94.7	5.3
Bangladesh ²⁰	25.40	31.10	33.80	9.7	-	-
Thailand ²¹	20.5	30.5	40.5	8.5	-	-
Pakistan ²⁵	31.95	27.99	28.66	11.34	92.45	7.55
Kenya ²²	26.20	22.00	47.48	4.4	80.13	8.60
Britain ²³	42.0	8.0	47.0	3.0	83.0	17.0
USA ²⁴	41.0	9.0	46.0	4.0	85.0	15.0

DISCUSSION

The distribution of blood groups among the subjects (n=11960) was found as 34.80% O group, 28.66% A group, 27.66% B group and 6.89% AB group. In ABO system, O blood group is dominant blood group in the present study. Similar results were found by Shrestha et al., Shah et al., Pramanik et al., and Upadhyay et al. but the result of our study is differ from the result found by Chapagain et al., Singh et al., and Humagain et al., who found that blood group A is the dominant blood group in Nepal.⁹⁻¹⁶

Interestingly table 4 shows that the result of the our study is similar to the result of study done in the population in India (Multicentric study and West Bengal), Bangladesh, Thailand, Kenya, Britain and USA but differ from the result of population of Pakistan.¹⁸⁻²⁵ The present result confirmed that blood group O is dominant, similar to Asian, European, African and American population but the present result is different from Muslim population.²⁵

The pattenen of blood group O > A > B > AB observed in this study was also observed by Shrestha et al., Sah et al. and

Table 5. Dominant blood groups in different Ethnic groups studied in Nepal.

Authors	Dominant Blood Group in different ethnic groups			
	A	B	O	AB
Shrestha et al. ⁹	Newar, Magar, Limbu and Sanyasi	Tharu and Marwari	Brahmin, Chhetri, Tamang, Lama, Gurung, Sherpa, Terai Brahmin, Muslim and Yadav	-
Pramanik and Adhikari ¹²	Chhetri and Newar	Sherapa and Lama	Brahmin, Magar and Gurung	-
Singh R ¹⁵	Newar, Chhetri and Tamang	Sherpa	Brahmin and Gurung	-
Present Study	Chhetri, Dhimal, Limbu, Muslim, and Rai	Biswakarma, Rajput, Satar and Tharu	Brahmin, Bhujel, Biswakarma, Shah, Gurung, Marwari, Magar, Mahato, Mandal, Newar, Sanyasi, Tamang, Terai Brahmin and Yadav	-

Pramanik et al.⁹⁻¹² It is interesting to note that the similar pattern of blood group distribution was also observed by Xu et al. in Chinese population.²⁶

Figure -2 shows that the frequency of ABO blood group distribution in Rh +ve and Rh -ve subjects. This result shows that there is difference in pattern of Rh +ve and Rh-ve blood groups distribution. The pattern of Rh +ve blood group distribution is O > A > B > AB, whereas the pattern for Rh -ve blood group is O > B > A > AB. Interestingly, the study found that in both the patterns, O is the commonest blood group and AB is least one.

Table -2 shows the ethnic variation of blood groups. It was found that O blood group was commonest in Brahmin, Bhujel, Biswakarma, Shah, Gurung, Marwari, Magar, Mahato, Mandal, Newar, Sanyasi, Tamang, Terai Brahmin and Yadav, whereas ethnic groups Chhetri, Dhimal, Limbu, Muslim, Rai had blood group A dominant. Similarly, blood group B was the most common blood group in Biswakarma,

Rajput, Satar and Tharu. Moreover, Blood groups O and B were equally dominant in Pariyar and Rajbansi and in Musahar; blood group A and B were equally dominant.

The Rh blood group was not equally distributed in all ethnic groups. Our study found that some ethnic groups, such as Bhujel, Dhimal, Limbu, Gurung, Marwari, Magar, Musahar, Rajput, Sanyasi and Tamang had only Rh +ve people. Satar had more Rh -ve (11.54%) people as compared to any ethnic groups studied all over Nepal.⁹⁻¹⁷

It is interesting to note that Tibeto- Burman group (Limbu, Tamang, Gurung, Magar etc.) people are less Rh -ve as compared to Indo-Aryan group (Brahmin, Chhetri, Yadav, Terai Brahmin etc).

Table-5 presents the blood group dominating ethnic groups observed by different studies in Nepal. Our study had shown that blood group O was dominant in Brahmin, Gurung, Yadav and Terai Brahmin, which is similar to results observed by Shrestha et al. Pramanik et al. and Singh.^{9,12,15} Similarly, this study presented that blood group A was commonest in Chhetri population and the similar result was observed by the studies by Pramanik et al. and Singh done in Nepal.^{12,15} It was also observed by this study and Shrestha et al. that Blood group B was commonest in Tharu population.⁹

Some interesting results were found in our study. Among Rh -ve group, Satar (11.54%), Biswakarma (1.69%), Pariyar (2.78%) and Rajbansi (1.11%) population had only A-ve people, Newar (0.97%) and Mahato (3.45%) were only O

-ve, and Terai Brahmin (2.38%) were only B -ve. On the other hand, AB -ve blood group was present only in Brahmin, Chhetri, Shah and Mandal. The Rh -ve blood group was significantly ($P < 0.005$) higher in Yadav population.

This research was conducted among the subjects who attend to the Nobel Medical College during the period August 1, 2015 to July 30, 2016. During the said period, the total number of subjects was 11960. The total number of subjects was divided into different ethnic groups. So it is natural the subjects of different ethnic groups never be equal.

CONCLUSION

Blood group O is dominant in the majority of the ethnic groups included in the study, whereas blood group AB was the least common among them. With regard to Rh system, Rh +ve is significantly more dominant than Rh -ve in all the ethnic groups of our study. This novel information of Eastern part of Nepal would prove helpful for planning the blood transfusion related health challenges in future in this region.

ACKNOWLEDGEMENT

We would like to thank Technical staffs of Central Laboratory and Mr. Tikendra Shrestha (IT In-charge) of Nobel Medical College Teaching Hospital, Biratnagar for cooperation for this study and providing valuable information.

REFERENCES

1. Waters AH. Red cell blood group antigens and antibodies. In: Dacie VJ and Lewis SM. Practical Haematology. 8th ed. London: Churchill Livingstone. 1995; P. 445-64.
2. Giri AP, Yadav P, Parhar GP, Phalke DB. Frequency of ABO and Rhesus Blood Groups: A Study from a Rural Tertiary Care Teaching Hospital in India. *Int J Biol Med Res.* 2011; 2(4): 988-90.
3. Waite GN. Blood components. In: Rhoades RA, Bell DR, editors. Medical physiology: principles for clinical medicine; 3rd ed. USA: Lippincott Williams & Wilkins, Philadelphia, 2009; P.169-86.
4. Svensson L, Bindila L, Angstrom J, Samuelsson BE, Breimer ME, Rydberg L et al. The structural basis of blood group A-related glycolipids in an A3 red cell phenotype and a potential explanation to a serological phenomenon. *Glycobiology.* 2011; 21(2): 162-74.
5. Purandare VR, Prasad NB. Distribution of ABO Blood Groups in healthy young adults in Pune City. *International Journal of Basic and Applied Medical Sciences.* 2012; 2(3): 74-8.
6. Garraty G, Dzik W, Issitt PD, Lubin DM, Reid ME, Zelinski T. Terminology for blood group antigens and genes-historical origins and guideline in the new millennium. *Transfusion.* 2000; 40: 477-89.
7. Rahman M and Lodhi Y. Frequency of ABO and Rhesus blood groups in blood donors in Punjab. *Pak J Med Sci.* 2004; 20: 315-8.
8. Mitra R, Mishra S, Rath GP. Blood Group Systems. *Indian J Anaes.* 2014; 58(5): 524-8.
9. Shrestha L, Malla U, Mahotra NB. ABO and Rh Blood Groups and their Ethnic distribution in a Teaching Hospital of Kathmandu, Nepal. *J Nepal Med Assoc.* 2013; 52(190): 311-5.
10. Shah JP, Pant DR, Shrestha V, Tiwari BR, Jaiswal S. Distribution of ABO, Rhesus blood groups and Haemoglobin concentration among the school students of Deurali VDC, Kaski, Nepal. *Int J Pharma Bio Sci* 2013; 3(4): 10-6.
11. Pramanik T, Saikia TC, Bandopadhyaya M. Preliminary report on the trend of blood group 2001; 41: 258-61.
12. Pramanik T, Adhikari P. Trend of blood group distribution among the different ethnic groups of Kathmandu valley. *Nepal Med Coll J.* 2006; 8(4): 248-9.
13. Upadhyay-Dhungle K, Basnkota GN, Das PK, Sohal A. Distribution of ABO and Rh blood groups in Nepalese Medical Students. *Janaki Medical College Journal of Medical Sciences.* 2013; 1(2): 17-20.
14. Chapagain R H, Subba B, Kunwar C B, Subedi J, Blengero J, Williams S, Towne B. Trend of Blood group distribution among Jirels of Nepal. *J Nep Med Assoc.* 2005; 44(160): 121-3.
15. Singh R. Distribution of ABO blood group in Nepal. *J Nepal Med Assoc.* 1985; 23(1):87-92.
16. Humagain M, Rokaya D. Evaluation of association between the prevalence and severity of Periodontal diseases and ABO blood groups among Nepalese adults. *Ind. J. Sci. Res. and Tech.* 2014; 2(3): 66-70.
17. Pramanik T, Pramanik S. Distribution of ABO and Rh blood groups in Nepalese medical students: a report. *Eastern Mediterranean Health Journal.* 2000; 6(1): 156-8.

18. Tiwari AK, Mehta N, Bhattacharya P, Wankhede R, Tulsiani S et.al. ABO and Rh (D) group distribution and gene frequency; the first multicentric study in India. *Asian J Transfus Sci.* 2014 Jul-Dec; 8(2): 121-5.
19. Nag I, Das SS. ABO and Rhesus blood groups in potential blood donors at Durgapur Steel city of the district of Burdwan, West Bengal. *Asian J. Transfus Sci.* 2012; 6: 54-5.
20. Boyd WC, Boyd LG. The blood groups and types of the Ramah Navaho. *Am J Phys Anthropol.* 1949; 7: 569-74.
21. Nathalang O, Kuvanont S, Punyaprasiddhi P, Tasaniyanonda C, Sriphaisal T. A preliminary study of the distribution of blood group systems in Thai blood donors determined by the gel test. *Southeast Asian J Trop Med Public Health.* 2001; 32(1): 204-7.
22. Lyko J, Gaertner H, Kaviti JN, Kariithi MW, Akoto B. Blood-group systems ABO and RH in the Kenyan population. *Folia Med Cracov.* 1992; 33: 85-92.
23. Frances TF. Blood groups (ABO groups). In: *Common Laboratory and Diagnostic Tests.* Philadelphia: Lippincott. 2002, 3rd ed: 19-5.
24. Mollison P L, Engelfriet C P, Conteras M. The Rh blood Group system. In *Blood Transfusion in Clinical Medicine*, 9th ed. Oxford: Black well Scientific Publication. 1993; 2008-9.
25. Ullah S, Ahmad T. Distribution of ABO and Rh (D) Blood Groups in the Population of District Dir Lower Khyber Pakhtunkhwa Pakistan. *World Applied Sciences Journal.* 2015; 33(1): 123-35.
26. Xu WH, Zheng W, Xiang YB, Shu XO. ABO blood type is associated with endometrial cancer risk in Chinese women. *Chin J Cancer.* 2011; 30(11): 766-71.