



DISTRIBUTION OF ABO AND Rh BLOOD GROUPS WITH HAEMOGLOBIN CONCENTRATION AMONG MEDICAL STUDENTS IN SHIVALIK REGION OF HIMALAYA

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ABSTRACT

Introduction: ABO and Rhesus blood groups are the utmost significant blood groups that are beneficial for transfusion purposes. The ABO and Rhesus blood groups vary from different populations, races and regions. This study was aimed for providing information on the distribution of ABO and Rhesus blood groups along with Haemoglobin concentration among undergraduate Medical students in VCSG Government Medical Science and Research Institute, Srinagar in Garhwal region of the Himalayan state of Uttarakhand during last 11 years..

Materials and Methods: 1098 undergraduate medical students mostly above 18 years had undergone blood test. The tests were purely based on antigen-antibody agglutination test by glass slide method using commercially available standard anti-sera (by Tulip Diagnostics Ltd. India). Estimation of haemoglobin was done by Sahli's acid-hematin method. Statistical analysis done using Microsoft Excel and SPSS version-21, percentage and student's t-test were applied to know statistical significance ($p < 0.5$).

Results: Blood group O among the ABO blood groups has the highest percentage frequency (32.1%) while blood group AB has the least percentage frequency (14%). Relationship among ABO blood groups were found $O > B > A > AB$. The total percentage of Rhesus-positive was 96.1% and that of Rhesus-negative was found to be 3.9%. Therefore, blood group O and Rhesus-positive has the highest frequency while blood group AB and Rhesus-negative has the least frequency. The mean concentration of haemoglobin (Hb%) with standard deviation was found 13.4 ± 1.7 among males while 12.9 ± 1.7 among females.

Conclusion: The present study gives vital information regarding management of blood banks and transfusion services in the community.

KEYWORDS : ABO Blood Group, Rh factor, Hb, Medical Students, Garhwal region

INTRODUCTION

Discovery of ABO and Rh blood group system is one of the eminent findings in the biological history of mankind. Karl Landsteiner, an Australian scientist, first discovered ABO blood group system in 1900 and recognized A, B and O blood group types. Landsteiner was awarded Noble Prize in Physiology and Medicine in the year 1930 for his renowned work^{1,2}. The blood group 'O' was initially designated as 'C' type by Landsteiner as it signifies lack of antigens A and B on the surface of RBC. It is even designated as "0" (zero) in some parts of Europe. In 1902, fourth type of blood group AB was discovered by Alfred Von Decastello and Adriano Sturli³. The Landsteiner's discovery unlocked the door to the birth of a wide spectrum of discoveries in the field of immune haematology, blood transfusion, unmatched pregnancy, legal medicine and anthropology. Even, other blood groups discovered are deemed as a result of Karl's discovery^{4,5}. Discovery of ABO system was manifested as an important achievement followed by Rh antigen discovery in the field of blood transfusion history^{6,7}. The Blood groups are determined genetically by the presence of specific antigens on the surface of erythrocytes (Red blood cells). The genes of ABO and Rh are located on chromosome 9 and 1. The antibodies against red blood cell antigens are called agglutinins present in the plasma and individuals are classified according to the presence or absence of antigens and agglutinins into four major blood groups, i.e. A, B, AB and O. The ABO and Rh blood

group antigens are hereditarily transmitted and are used in studies relating to population genetics, patterns of population migration and also determining certain medico legal issues, mainly issues of paternity disputes. The blood group studies are not only important in evolution but also in modern medicine where the relation between blood groups and diseases, environment is increasingly being studied⁸. Some blood groups are more susceptible to some diseases like duodenal ulcer, diabetes mellitus, urinary tract infection and blood group incompatibility in newborn⁹. Proportions of people belonging to these blood groups are different in different communities. Blood group distribution also varies between races, population, among same population in different time zones and also differs in different geographical location. So for the execution of effective management of blood banks and safe transfusions, knowledge of ABO and Rhesus blood groups distribution at local and regional levels is highly significant¹⁰. The significance of the Rh blood group is highly essential as Rh antigens are highly immunogenic. After ABO system, Rh blood group is the second most common and has almost 50 well-defined antigens. Among these, five antigens namely C, D, E, c, d and e are more important. The terms commonly used in Rh system like Rh factor, Rh positive and Rh negative depending on the presence or absence of antigen 'D'. The D antigen, along with its role in blood transfusion, also used in determination and management of haemolytic diseases of newborn (like erythroblastosis fetalis

etc). Individuals who do have D antigens in their body will produce anti-D antibodies when exposed to D antigen present on RBCs during mismatched blood transfusion causing a haemolytic transfusion reaction (HTR) or upon foetal RBCs causing haemolytic disease of new born (HDN). For this reason, the Rh status is routinely determined in blood donors, transfusion recipients and in expected mothers. Knowledge of blood group distribution is also important in reducing mortality rate by accessing of safe blood transfusion. This knowledge is also important for clinical studies and geographical information. So, it is very important to know about blood group distribution pattern in any population¹¹. This present study was conducted to know the ABO and Rh blood group distribution and haemoglobin concentration among medical students in Garhwal region of Himalayan state of Uttarakhand.

MATERIALS AND METHODS

This retrospective study was carried out among medical students in Department of Physiology of Veer Chandra Singh Garhwali Government Medical Science and Research Institute, Srinagar, Uttarakhand during last 11 years from 2008 to 2018. Srinagar city is an important historical, educational and cultural centre of Garhwal region located in the foothills of Shivalik Ranges of the Greater Himalayas and nearly 156 km away from state capital, Dehradun, located on the left bank of river Alakananda with an average elevation of 560 meters (1837 feet) above sea level¹²⁻¹⁴. The Institutional ethical committee clearance was obtained.

Total numbers of 1098 medically fit undergraduatemedical students had undergone blood test in haematology laboratory. Mostly all individuals were above 18 years of age. The tests were purely based on antigen-antibody agglutination test. The ABO blood grouping and Rh typing was determined by glass slide method, after collecting blood samples by finger prick method using lancet needles under aseptic precautions. Blood samples were collected from one of the middle three fingers and three separate glass slides marked as A, B and D were used to detect A, B, AB, O group and whether they are Rh positive or negative. Commercially available standard anti sera (by Tulip Diagnostics Ltd. India) – anti-A, anti-B and anti-D were used for the agglutination test to detect blood group. Glass slides marked as A, B and D were used to mix suspended RBCs with anti-A, anti-B and anti-D anti sera. Separate applicator sticks were used to mix blood drop with anti-sera for three glass slides to prevent false results. The mixture observed for agglutination, macroscopically and again microscopically for confirmation and compared with control. The glass slide method of blood group determination is purely based on antigen-antibody agglutination test. The antigen present on the surface of RBC agglutinates with the antibody present in the antisera. So, blood group was determined based on agglutination with the corresponding anti sera. If agglutination was present in the blood drop on slide marked A, then it belongs to A blood group, agglutination in blood drop slide B, B group, agglutination in both A and B drops, AB group and if there was no agglutination in both A and B drops, then O group. Similarly, agglutination in blood drop on glass slide marked D was considered as Rh Positive and no agglutination as Rh negative^{11,12}. Estimation of haemoglobin was done by Sahli's acid-hematin method expressed in gram percentage (gm%) in the same laboratory.

Statistical analysis:

Collected data were entered into Microsoft Excel and analysed using SPSS of windows version-21 (Trial). Descriptive statistical measures such as percentage and Student t-test were applied to identify the relationship between variables and to know statistically significant ($p < 0.05$).

RESULTS

A total of 1098 medical students, out of which 494 (45%) were

males whereas 604 (55%) were females. In this study, the most frequently occurring blood group was found 'O' (32.1%) followed by 'B' group (30.7%), 'A' group (23.2%) and AB group (14%) were found. Finally the relationship among ABO blood groups were found $O > B > A > AB$ respectively. 1056 (96.1%) students were Rh positive, while only 42 (3.9%) were found Rh negative and the association of the positive as well as negative rhesus factor among the ABO blood groups were also found $O > B > A > AB$ as shown in table-1 and figure-1 respectively.

Table-2 showed the gender wise distribution of ABO blood group with relation to Rh factor. Among the males, 'O' blood group 174 (35.2%) was the most frequently observed followed by B group 147 (29.7%), A group 108 (21.9%) and AB comprised of 65 (13.2%) and relationship was found $O > B > A > AB$. Out of 494 male students, it was found that 97% positive and 3% negative with respect to rhesus factor having similar relationship. Among the female category, 'B' blood group 190 (31.4%) was the most commonly observed, O group 178 (29.5%), A group 148 (24.5%) and AB comprised of 88 (14.6%) and relationship defined as $B > O > A > AB$. Out of 604 female students 95.5% and 4.5% were positive and negative respectively with respect to rhesus factor. Among the Rh positive females the relationship was found $B > O > A > AB$ while among negative female $O > B > A > AB$ as shown in figure-2.

Among the males, the mean \pm SD concentration of haemoglobin (Hb%) was found 13.4 ± 1.7 while in females it was seen 12.9 ± 1.7 . The association was found statistically significant. In this study, all blood groups were found statistically significant ($p < 0.05$) except 'AB' blood group by the application of student t-test as shown in table-3.

DISCUSSION

ABO and Rh blood group distribution studies are significant as they play a vital role in blood transfusion, organ transplantation, research in the field of genetics, human evolution and forensic pathology. Some blood groups are more prone for some diseases like diabetes mellitus, duodenal ulcers, UTI etc. Blood groups are also known to have genetic association with many diseases³. Previous many studies conducted displayed that A group individuals are more susceptible to cardiovascular diseases like coronary heart disease (CHD), venous thrombosis, ischemic heart disease (IHD) and atherosclerosis. These types of diseases are less susceptible in people with O blood group, which stated to have protective benefit. These O group individuals are acknowledged to have protection against squamous and basal cell carcinoma with risk being reduced by 14% and 4% respectively as compared to other groups. O group also have less risk of pancreatic cancer. The ovarian cancer is more prone in individuals having B antigen. A group people having more association with gastric cancer whereas it is least in O group individuals. Therefore, it is highly important to do blood grouping studies in each and every region to have appropriate national transfusion policies and to supply blood during emergency situations to the needy people^{11,15}. The blood group distribution has been observed to be different in different parts of the world based on ethnic origin of races. Indian from South Africa belong to O blood group whereas O and A blood groups were common in Australian origins. B group was found to be common in Africans whereas A among Europeans. Among US population, 46% is group O, 41% A, 9% B and 4% AB¹⁶. Blood group distribution also differs in different populations inside India and also vary in different districts in each state of India.

In our study, the frequency distribution of blood group O was the highest followed by blood group B, A and AB respectively. The study also confirmed that Rhesus positive

(96.1%) was having higher percentage frequency while Rhesus-negative (3.9%). Among males, relationship was found blood group O>B>A>AB where 97% are positive and 3% are found negative whileamong females relationship was found blood group B>O>A>AB where 95.5% and 4.5% were positive and negative respectively.

The frequency of Rh negative was found to be more in females than in males howeverRhesuspositive was higher in males than in females. Blood group AB was the least common blood group as similar to the study by Chandra et al.¹⁷ and Sindhu et al. revealed that blood group B is the most commonest among Punjab in Northern parts of India followed by O, A and AB¹⁸. Similar result revealed that B blood group was also found to be predominant in Ahmedabad region, the western part of India followed by O, A and AB¹⁹. Studies done at Surat by Nidhi Mehta et al.²⁰ and GiriPA et al.²¹ in Maharashtra, showed that the B group was commonest among people studied followed by O, A and AB groups. All these studies showed Rh positive as predominant group compared to Rh negative. Study done in Eastern part of India, at Durgapur, West Bengal by Nag et al.²² and in Southern part of India by Periyas et al.²³ at Bangalore, Das PK et al.²⁴ at Vellore and at Davangere by Mallikarjuna S. et al.²⁵ found that commonest blood group was O followed by B, A and AB which were similar to our study.

According to the available literature, over 99% Asians belong to Rh positive group but among our subjects 96.1% were Rh (+)ve and 3.9% Rh (-)ve. It is close to the findings ofParmanik T and Parmanik S,among Nepalese students in Nepal medical college, Kathmandu. Their subjects were 96.66% Rh (+)ve and 3.34% Rh (-)ve²⁶. Rh blood group is documented as 5% in Nairobi²⁷ and 4.5% in Nigeria²⁸.The mean haemoglobin concentration found in our study among male students was found 13.41 gm% and blood group B contributed highest mark of 13.92 gm% whereas among the female students mean Hb concentration was found 12.91 gm% with blood group O marked the maximum of 13.30 gm%.

Blood group distribution informationare not only significant for blood bank management but also for clinical studies, geographical information and forensic studies. Blood groups are required notonly for transfusion purposes but also for preventing diseases associated with blood groups,inhibition of dangerous transfusion reactions occurs due to mismatched blood transfusions, effective management of blood bank and to provide blood to needy patients. This blood group distribution knowledge is important to determine recruitment of voluntary donors in case of emergencies. The importance of blood group determination lies in the transfusion of blood among different populations irrespective of their age, gender, ethnic origin, in organ transplantation and indevelopment of legal medicine, genetic research, and study of anthropology.

CONCLUSION

This study concluded that blood group O was found to be more common among the medical students whereas AB blood group was found to be the least in the Garhwal region of Shivalik ranges. Rh positive blood group was most common than Rh negative. In conditions of emergency transfusions, the blood groups indicated on identity cards of school or colleges, driving licenses will be of great use. This study along with other similar studies in other regions inour country will be very much beneficial for health planners to face medical emergencies.

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Conflict of Interest: Nil

Blood Group	Rh Factors		Total (%)
	Positive (%)	Negative (%)	
A	250(22.6)	6(0.6)	256(23.2)

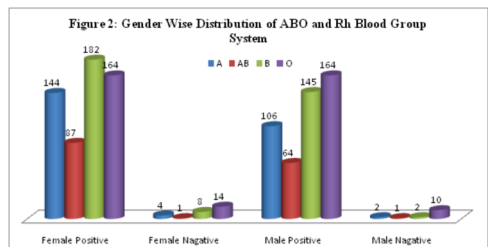
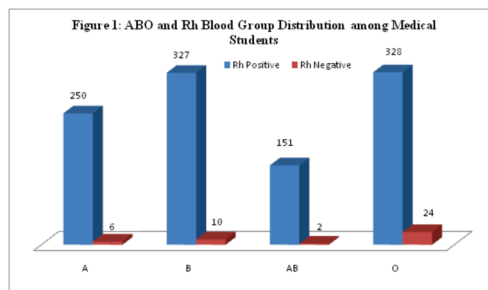
B	327(29.8)	10(0.9)	337(30.7)
AB	151(13.8)	2(0.2)	153(14)
O	328(29.9)	24(2.2)	352(32.1)
Total	1056(96.1)	42(3.9)	1098(100)

Table 2: Gender wise Distribution of ABO and Rh Blood Group System

Blood Group	Male			Female		
	Positive (%)	Negative (%)	Total (%)	Positive (%)	Negative (%)	Total (%)
A	106 (21.5)	2(0.4)	108(21.9)	144(23.8)	4(0.7)	148(24.5)
B	145(29.3)	2(0.4)	147(29.7)	182(30.1)	8 (1.3)	190(31.4)
AB	64(13.0)	1(0.2)	65(13.2)	87(14.4)	1(0.2)	88(14.6)
O	164(33.2)	10(2.0)	174(35.2)	164(27.2)	14(2.3)	178(29.5)
Total	479(97)	15(3)	494(100)	577(95.5)	27(4.5)	604(100)

Table 3: Distribution of Haemoglobin (in gm %) according to Gender

Blood Group	Male		Female		t - test value	p value
	Mean	S.D	Mean	S.D		
A	13.81	1.77	12.72	1.66	5.04	<.001
AB	12.94	1.69	12.71	1.77	0.81	>0.05
B	13.92	1.57	12.79	1.70	6.25	<.001
O	12.90	1.67	13.30	1.75	2.19	<.05
Total	13.41	1.73	12.91	1.73	4.76	<.001



REFERENCES

- Landsteiner K. Zur Kenntnis der antifermentativen, lytischen und agglutinierenden Wirkungen des Blutserums und der Lymphe; Zentralblatt Bakteriologie; 1900; 27: 357-62.
- vonDecastello A, Sturli A. Ueber die Isoagglutinineim Serum gesunder und kranker Menschen; Mfinch med Wschr; 1902; 49: 1090-5.
- Janský J. Haematologickstudie u. psychotikuSborn; Klinick (in Czech); 1907; 8: 85-139.
- Jolly JG. Medico legal significance of human blood groups; J Indian Med Assoc. 2000; 98: 340-341.
- Khurshid B, Naz M, Hassan M, Mabood SF Frequency of ABO and Rh (D) blood groups in district Swabi, NWFP, Pakistan; J Sci Tech University Peshawar, 1992; 16: 5-6.
- GarrattyG, Dzík W, Issitt PD, Lublin D M, Reid ME, Zelinski T. Terminology for blood group antigens and genes-historical origins and guideline in the new millennium; Transfusion; 2000; 40: 477-489.
- Mollison PL. The genetic basis of the Rh blood group system; Transfusion; 1994; 34: 539-541.
- D. Platt, W. Muhlberg, L. Kiehl, R. Schmitt-Ruth ABO blood group system, age, sex, risk factors and cardiac infarction; Arch Gerontol Geriatr.1985; 4: 241-249.
- Skaik Y, El-Zyan N. Spectrum of ABO and Rh (D) blood groups amongst the Palestinian students at Al-Azhar University-Gaza; Pak J Med Sci. 2006; 22: 333-335.
- P Patel, P Sangeeta, S. Jigesh, O. Haren. Frequency and distribution of blood groups in donors in Western Ahmedabad-A hospital based study; Nat J Med Res. 2012; 2: 202-206.
- Hemalatha N.R. ABO and Rh Blood Group Distribution among Medical Students in Mandya; International Journal of Contemporary Medical Research; Volume 4, Issue 8, August 2017; 1655-1658.
- Satish Kumar, Purab Kalyan Modak, S. Haroon Ali, S. K. Barpanda, Vimal Singh Gusain, Rupali Roy. A retrospective study: ABO and Rh phenotype blood group distribution among blood donors in H.N.B. Base Hospital,

- Srinagar, Uttarakhand, India; Journal of Family Medicine and Primary Care; ISSN 2249-4863; Volume 7 / Issue 1 / January-February 2018; 34-38.
13. Negi SS. A Historical township. In: Souvenir of 20th Convention of Indian Association of Sedimentologist. Srinagar; 2003. p. 1-29.
 14. Census of India 2001: Data from the 2001 Census, Including Cities, Villages and Towns (Provisional). Census Commission of India. Archived from the Original; 2004. Available from: https://en.wikipedia.org/wiki/Census_town. [Last retrieved on 2008 Dec 01].
 15. Swamy CM, Basavaraj PB, Kavitha GU, Shashikala P. Prevalence of ABO and Rhesus blood group among blood donors. Indian J Public Health Res Dev. 2012;3:106-9.
 16. Khan MI, Micheal S, Akhtar F, Naveed A, Ahmed A and Qamar R. Association of ABO blood groups with glaucoma in the Pakistani population. Can J Ophthalmol. 2009;44:582-6.
 17. Tulika C, Gupta A. Frequency of ABO and Rhesus blood groups in blood donors. Asian J Trans Sci. 2012;6:52-3.
 18. Sindhu S. Distribution of the ABO blood groups and Rh (D) factor among the scheduled caste population of Punjab. Anthropologist. 2003;5:203-4.
 19. Hina Mod, Ashok Solanki. The distribution of ABO and Rh (D) blood groups in local residents of Ahmedabad. International Journal of Scientific Research. 2013;2: 275-6.
 20. Mehta N, Swadas B. Prevalence of ABO blood groups at Mahavir Heart Institute Surat. Asian J Trans Sci. 2012;6:74-5.
 21. Giri PA, Yadav S, Parhar GS, 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;2:988-90.
 22. 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.
 23. Periyar S, Sangeetha SK, Marimuthu P, Manjunath BK, Seema DM. Distribution of ABO and Rhesus-D blood groups in and around Bangalore. Asian J. Transfus. Sci. 2010;4:41.
 24. Das PK, Nair SC, Harris VK, Rose D, Mammen JJ, Bose YN, Sudarsanam A. Distribution of ABO and Rh-D blood groups among blood donors in a tertiary care centre in South India. Trop Doct. 2001;31:47-8.
 25. Mallikarjuna S. Prevalence of ABO and Rhesus blood group among blood donors. Ind J Pub Health Research and Development 2012;3:106-9.
 26. Parmanik T, Parmanik S. Distribution of ABO and Rh blood groups in Nepalese medical students: a report. Eastern Mediterranean Health Journal. 2000;6:156-8.
 27. Mawuagi J. Blood group distribution in urban population of patient targeted blood donors. East Afr. Med. J. 1999;76:615-8.
 28. Omotade OO, Adeyemo AA, Kayode CM, Falade SL, Ikpe S. Gene frequencies of ABO and Rh (D) blood group allele in a healthy infant population in Ibadan, Nig. West Afr. J. Med. 1999;19:294-7.