

## ABO and Rhesus –D blood group distribution among voluntary blood donors in north-central Nigeria.

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### Abstract

*Background: Understanding ABO and Rh blood group distribution is crucial for the functional and successful handling of blood bank inventory and effective management of safe blood transfusion services. The distribution of ABO and Rh phenotypes tends to vary among different regions and races. Objectives: This study was carried out to provide relevant data on the distribution of ABO and Rh-D blood group phenotypes in the North-central region of Nigeria. Methods: This descriptive study included a total of 905 students and staff of 5 Tertiary Institutions in Kogi and Kwara States, North Central Nigeria. The ABO and the Rhesus blood groups were determined using the tile technique method. Forward blood grouping was done using standard antisera A, antisera B, and antisera D. The statistical data were presented in number (frequency) and percentage. Results: Group O phenotype was the most frequent blood group phenotype with over two-thirds (67.76%) of the population studied. This was followed by B and A with 16.98% and 13.55% respectively. The AB blood group was the least observed phenotype with a frequency of 1.71%. The Rh-D antigen was detected in 479 (74.61%) of the voluntary blood donors while the Rh-D negative phenotype was found in 163 (25.39%) of the population. Conclusion: Our study's most common blood group was the O blood group followed by the B, A, and AB blood groups. Most voluntary blood donors were Rh-D positive, constituting 93.2% of the population studied.*

*Keywords: ABO blood group, Rh-D, frequency distribution*

### Introduction

The ABO blood group typing is essential in ensuring safety in blood transfusion practices. Of all the blood group antigens, the ABO blood group antigens are the most immunogenic and remain one of the prime importance in transfusion medicine <sup>1</sup>. To operate blood bank services effectively, well-organised management of the blood bank inventories is essential. Thus, a regular uninterrupted supply of blood will be guaranteed and waste will be reduced significantly. To achieve this, the knowledge of the

distribution of ABO and Rh blood groups is crucial for the effective management of blood bank inventory and safe blood transfusion services, be it the facility of a small local transfusion service or a regional or national transfusion service <sup>2</sup>. Information on ABO blood group distribution is also important for genetic knowledge, genetic analysis and medical verdict as well as for the general well-being of the populace <sup>3</sup>. Some specific links have been established between certain ABO phenotypes and increased vulnerability to some types of diseases. Stomach ulcers have been found to be commoner among those with the blood group O phenotype while gastric cancer is commoner among those with the blood group A phenotype <sup>4</sup>.

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There is variation in the distribution of ABO and Rh blood group phenotypes among different regions and races worldwide. Blood group O was the predominant blood group among the Americans and the Chinese while blood group A was the most frequent in Japan <sup>5,6</sup>. Studies done in some parts of Nigeria and Uganda also showed that blood group O is the most common phenotype, followed by blood group A and then B. Blood group AB was the least common blood group <sup>7,8</sup>.

This study was conducted to provide relevant data on the distribution of ABO and Rh-D blood group phenotypes in the North-central region of Nigeria. This data is essential to guide blood bank service providers on the availability of blood-by-blood type.

## Materials and Methods

This descriptive study included a total of 905 students and staff of 5 Tertiary Institutions in Kogi and Kwara States, North Central Nigeria. The study was conducted between August 2016 and January 2018. For this study, the inclusion criteria included blood donors between the ages of 18–65 years and a haemoglobin concentration of 13.0 g/dL and above for males and 12.0 g/dL for females as recommended by WHO. Only 644 of the voluntary donors eventually completed the study as some of them were rejected based on low haemoglobin levels, making them unfit for blood donation. All participants gave consent to participate in this study.

The Ethical Committee of the University of Ilorin Teaching Hospital, Ilorin, approved the study protocol. Approval to conduct the study was also obtained from the heads of the other various tertiary Institutions

A structured self-administered questionnaire was used to collect relevant information on the socio-demographic data of the blood donors.

A brief physical examination was done for each prospective donor. Three millilitres of venous blood were obtained from the prospective blood donors via venipuncture using an aseptic technique. The collected samples were then dispensed into labeled plain vacutainer bottles. The blood samples were then transported to the blood bank with a cold box and the

cold chain temperature was maintained at 2–10°C. After arrival at the blood bank, samples were stored in a refrigerator (2–6°C).

The ABO and the Rhesus blood group phenotypes of each of the participants were determined by the tile technique method. Forward blood grouping was done using commercially available standard antisera A, antisera B, and antisera D. The antisera validation was done using appropriate positive and negative controls.

One drop of blood from each sample was mixed with a drop of appropriate anti-sera and rocked gently. Reverse grouping was used to confirm doubtful results <sup>9</sup>.

## Statistical Analysis

The frequency of ABO and Rh-D blood groups were calculated and expressed in percentages.

## Results

Table 1 shows the distribution of various ABO phenotypes among the voluntary blood donor studied.

**Table 1: Distribution of ABO blood group phenotypes among voluntary blood donors**

ABO Blood Group	Frequency (n)	Percentage (%)
A	87	13.5
B	109	17
AB	11	1.7
O	437	67.8
<b>TOTAL</b>	<b>644</b>	<b>100</b>

Group O was the most frequent blood group phenotype with over two-thirds (67.76%) of the population studied. This was followed by blood groups B and A with percentages of 16.98% and 13.55% respectively. The AB blood group was the least encountered phenotype with a frequency of 1.71%.

Table 2 shows the frequency distribution of the Rhesus-D phenotype among the voluntary blood donors.

**Table 2: Rhesus D blood group distribution among the voluntary blood donors**

ABO blood Group	Rhesus D positive	Rhesus D negative
A	83(12.9%)	4(0.6%)
B	106(16.5%)	3(0.5%)
AB	11(1.7%)	0(0%)
O	400(62.1%)	37(5.7%)
Total	600(93.2%)	44(6.8)

Rh-D antigen was detected in 600 (93.30%) of the voluntary blood donors while Rh-D negative phenotype was found in 44 (6.80%) blood donors.

**Table 3: Frequency distribution of ABO blood group among the genders.**

	A	B	AB	O
Male	58	62	9	266
Female	29	47	2	171
Total	87	109	11	437

## Discussion

Our study included 644 voluntary non-remunerated blood donors. The majority of the blood donors were males 396 (61.2%), while the females were 248(38.8%) with male to female ratio of 1.6: 1. Most of them 410 (63.7%) were within the age range of 18–55years (mean age in years).

In our present study, the most common blood group phenotype was O followed by B, and A, while the least frequent blood group was AB. Our findings are consistent with a similar study done among voluntary blood donors in a tertiary institution blood drive by Martina *et al* in South-Eastern, Nigeria<sup>10</sup>. Also, similar reports were obtained by Kulkami *et al*, Damulak *et al* in Northern Nigeria and Adienbo *et al* in southern Nigeria, respectively<sup>11,12,13</sup>.

The findings of our report were consistent with other similar studies done elsewhere in Africa as reported by Loua *et al* in Guinea, Apecu *et al* in Uganda and Jahanpour *et al* in Tanzania<sup>14,15,16</sup>. A similar

distribution was observed among the Bangladesh population<sup>17</sup>.

Blood Group O phenotype appears to be the dominant blood group found in Nigeria while AB seems to be the least as observed in the studies reported so far<sup>10,11,12</sup>. However, in contrast to our study, blood group A was reported to be next to blood group O in studies done among blood donors by Nwauche *et al*<sup>18</sup> and Enosolease *et al*<sup>19</sup> both in South-South, Nigeria. The distribution in frequencies of the ABO blood group distribution in our study revealed O (67.76%), B (16.98%), A (13.55%) and AB (1.71%). This is similar to the findings of the study done by Adienbo *et al* in South-South, Nigeria<sup>13</sup>. However, in contrast to our present study, a study done by Premanik *et al* in Nepal found the commonest blood group to be A followed by O, B and then AB while studies done by Rajshree *et al.*, Sigh *et al.* and Rahman *et al.* in India, Jharkhand and Pakistan respectively revealed blood group B to be the commonest blood group followed by O, A and AB<sup>20,21,2, 22</sup>.

These differences in the frequency distribution of ABO blood groups might be related to genetic variations of the study participants. Our study shows that the distribution of the Rh D positive blood group was 93.2% while the Rh D negative blood group was 6.8%. This is similar to the findings reported by Enosolease *et al*<sup>19</sup> in Benin City and Adeyemo *et al*<sup>23</sup> in Lagos, Nigeria with the frequency of Rh-D negative phenotype of 6% and 5.46% respectively. Thus, Nigeria's predominant Rhesus D phenotype is Rh D positive phenotype<sup>19,23</sup>. Similar studies done by Legese B *et al*<sup>24</sup> in Ethiopia among voluntary blood donors also showed that the Rh-D positive blood group was the most predominant Rh-D blood group phenotype with 92.7% and the rest (8.5%) was Rh-D negative<sup>24</sup>. However, in contrast to our study, a reasonably higher frequency of Rh D negative blood group phenotype was reported by Golassa *et al* in Ethiopia and Mollison *et al* in the USA with values of 19.37% and 15% respectively<sup>25,26</sup>.

## Conclusion

In our study, the blood group O phenotype was the most common followed by the B, A, and AB blood

groups. Most (93.2%) of the voluntary blood donors were Rhesus D positive. ABO and Rh blood group frequency distribution appears to vary among different regions and races worldwide.

## References

1. Calhoun L, Petz LD. Erythrocyte antigens. In: Beutler E, Lichman MA, Coller BS, Kipps TJ, Selisohn U, Editors. Williams's haematology. 6th Ed. New York: McGraw-Hill, Inc, Health Professions Division; 2001:1849-57.
2. Singh A, Srivastava RK, Deogharia KS, Singh KK. Distribution of ABO and Rh types in voluntary Blood donors in the Jharkhand area as a study conducted by RIMS, Ranchi. *J Family Med Prim Care*. 2016; 5(3):631-636.
3. Frequency of ABO and Rh (D) blood groups involving volunteer donors in district Nowshera.." the free library.2017. *Asianet-Pakistan*. 2017;14.
4. Dean L. Blood Groups and Red Cell Antigens [Internet]. Bethesda (MD): National Center for Biotechnology Information (US); 2005. Chapter 5, The ABO blood group. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK2267/> Accessed when?
5. Garratty G, Glynn SA, McEntire R. Retrovirus Epidemiology Donor Study. ABO and Rh (D) phenotype frequencies of different racial/ethnic groups in the United States. *Transfusion*. 2004;44 (5):703–706.
6. Liao H, Li J. Distribution characteristics of ABO and Rh D blood groups among the voluntary blood donors in Chongqing: a retrospective study. *Medicine*. 2020;99 (42):e22689. doi:10.1097/
7. Egesie U, Egesie OJ, Usar I, Johnbull TO. Distribution of ABO, Rhesus blood groups and haemoglobin electrophoresis among the undergraduate students of Niger Delta University Nigeria. *Niger J Physiol Sci*. 2008;23(1–2):5–8.
8. Apecu RO, Mulogo EM, Bagenda F, Byamungu A. ABO and Rhesus (D) blood group distribution among blood donors in rural south-western Uganda: a retrospective study. *BMC Res Notes*. 2016;9(1):1–4
9. Dacie JV, Lewis SM. Practical haematology. In: Lewis SM, Bain BJ, Bates I, editors. 9th ed. Churchill Livingstone, Harcourt Publishers Limited: London; 2001. p. 444-51.
10. Martin AN, Okorie GO, Obiageli MA, Chekwube BE. Distribution of ABO and Rhesus Blood Groups among Voluntary Blood Donors in Enugu. *Int. blood res*. 2015;3 (3):109-116.
11. Kulkarni AG, Peter B, Ibazebo R, Dash B, Fleming AF. The ABO and Rhesus groups in the northof Nigeria. *Ann Trop Med Parasitol*. 1985; 79 (1): 83- 8.
12. Damulak OD, Bolorunduro S, Deme KS, Yakubu RS, Zhakom PN, Tokbam L. ABO Blood Group Distribution among Voluntary Blood Donors in North Central Nigeria: The Implications on Blood Units Expiration. 2011;13(2):102-104.
13. Adienbo O M, Nwafor A, Egwurugwu J N, Okon UA. The distribution of ABO and Rhesus blood groups among indigenes of the Ijaw ethnic group in the niger delta region, Nigeria. *Global Journal of Pure and Applied Sciences*. 2010;16 (3): 345-348.
14. Loua A, Lamah MR, Haba NY, Camara M. Frequency of ABO blood group and rhesus D in the Guinean population. *Transfus Clin Biol*. 2007; 14:435-439.
15. Apecu RO, Mulogo EM, Bagenda F, Andrew B. ABO and Rhesus (D) blood group distribution among blood donors in rural south-western Uganda: a retrospective study. *BMC Res Notes*. 2016. 9:513.
16. Jahanpour O, Pyuza JJ, Ntiyakunze EO, Mremi A, Shao ER. ABO and Rhesus blood group distribution and frequency among blood donors at Kilimanjaro Christian Medical Center, Moshi, Tanzania. *BMC Res Notes*. 2017;10(1):73-8.
17. Talukder S, Das R. Distribution of ABO and Rh blood groups among blood donors of Dinajpur district of Bangladesh. *Dinajpur Med Col J*. 2010;3:55–8.
18. Nwauche CA, Ejele OA. ABO and Rhesus antigens in a cosmopolitan Nigeria population. *Niger J Med*, 2004; 13 (3) :263-266
19. Enosolease ME, Bazuaye GN. Distribution of ABO and Rh-D blood groups in the Benin Area of Niger- Delta. Implication for regional blood transfusion. *Asian J Tansfus Sci*. 2008; 2: 3-5.
20. Pramanik T, Pramanik S. Distribution of ABO and Rh blood groups in Nepalese medical students: a report. *East Mediterr Health J*. 2000; 6:156–8.
21. Rajshree B, Raj JY. Distribution of ABO blood group and Rh (D) factor in western Rajasthan. *Natl J Med Res*. 2013; 3:73–5.
22. Rahman M, Lodhi Y. Frequency of ABO and Rhesus blood groups in blood donors in Punjab. *Pak J Med Sci*. 2004; 20:315–8.
23. Adeyemo OA, Soboye JO, Omolade B. Frequency distribution of ABO, RH blood groups and blood genotype among cell biology and genetics students of University Lagos, Nigeria. *African J. Biotech*. 2006; 5 (22): 2062 – 2065.
24. Legese B, Shiferaw M, Tamir W, Tiruneh T. Distribution of ABO and Rhesus Blood Group Phenotypes Among Blood Donors at Bahir Dar Blood Bank, Amhara, Northwest Ethiopia: A Retrospective Cross-Sectional Study. *J Blood Med*. 2021; 12:849-854.
25. Golassa L, Tsegaye A, Erko B, Mamo H. High rhesus (Rh (D)) negative frequency and ethnic-group based ABO blood group distribution in Ethiopia. *BMC Res Notes*. 2017;10(1):1–5.
26. Mollison PL, Engelfriet CP, Conteras M. The Rh blood group system. In: *Blood Transfusion in Clinical Medicine*. 9th ed. Oxford: Black Well Scientific Publication; 1993. p. 2008-9.