

SJMLS - 10(1) - 036

Prevalence of Du Antigen among RhD-Negative Blood Donors at University College Hospital, Ibadan.

Alabi Raphael*, Adeoye Aliyah Adesalewa, Amusan Festus Olatunbosun, Adesina Beatrice Egun, Inegbenebor Sylvester Ehilenbalu, Akpan Richard Peter, Oniye Adesola Helen

Department of Medical Laboratory Science, Faculty of Basic Medical and Health Sciences, Lead City University, Oyo State, Nigeria.

Author for Correspondence*: raphvee@yahoo.com/+234-812-435-3729.
<https://dx.doi.org/10.4314/sokjmls.v10i1.36>**Abstract**

In transfusion medicine, the Du antigen a variation of the RhD antigen is crucial because of its implications for transfusion reactions and haemolytic disease of the foetus and newborn (HDFN). The Du antigen is clinically significant, but its prevalence in many areas, including Nigeria, is still poorly understood, which presents problems for Rh typing accuracy and transfusion safety. This study aims to determine the proportion of RhD-negative blood donors and the prevalence of the Du antigen among these donors at the University College Hospital (UCH), Ibadan. This cross-sectional study was carried out at UCH, Ibadan and included 50 RhD-negative blood donors. Standard serological procedures were used to obtain blood samples and test them for the Du antigen. Demographic data, including age, gender, and ethnicity, were evaluated alongside serological results. A statistically significant correlation was established between donor age and the prevalence of the Du antigen, whereas no significant correlations were detected with gender or ethnicity. All individuals were confirmed to be RhD-negative, with 6% testing positive for the Du antigen. The results emphasize the necessity for tailored age-specific donor techniques to improve transfusion procedures and guarantee optimal clinical outcomes. Routine Du antigen testing among RhD-negative blood donors is crucial for correct Rh typing and transfusion safety.

Keywords: RhD-negative, Du antigen, blood donors, prevalence, transfusion safety, serology, Nigeria.

Introduction

In transfusion medicine, the Rh blood group system and the weak D antigen in particular presents serious difficulties because of its modest expression, which frequently eludes conventional serological detection techniques. As a weak variation of the RhD antigen, the Du antigen makes it difficult to determine the Rh D status and requires sophisticated methods like molecular genotyping and indirect antiglobulin testing (IAT) for precise identification (Gavrovskaya *et al.*, 2023; Emily *et al.*, 2024). Differentiating between weak D and incomplete D phenotypes is crucial because they represent different risks for alloimmunization after transfusion, according to recent developments (Gavrovskaya *et al.*, 2023; Sippert *et al.*, 2024). To prevent negative transfusion responses, people with partial D need RhD-negative units, whereas those with weak D can safely receive RhD-positive blood (Emily *et al.*, 2024). The clinical implications of the Du antigen are profound, especially with regard to its misclassification in transfusion medicine and pregnancy, which can result in alloimmunization and hemolytic transfusion reactions or hemolytic disease of the fetus and newborn (HDFN) (Owaidah and Yamani, 2023; Emily *et al.*, 2024).

Accurate diagnostics are crucial because weak D and partial D variants have a significant impact on transfusion practices and prenatal care (Owaidah and Yamani, 2023; Matzhold *et al.*, 2024). While people with weak D phenotypes may safely receive RhD-positive blood, those with partial D phenotypes are at higher risk for alloimmunization and require Rh D-negative

units (Emily *et al.*, 2024). Innovative technologies like nanopore sequencing hold promise for improving the accuracy of RhD genotyping, facilitating better management of blood supplies and patient safety (Tounsi *et al.*, 2022). Furthermore, because Rh D variations are more common in pregnant women, frequent genotyping is necessary to avoid anti-D alloimmunization, which can happen when Rh D variants are mistakenly labeled as Rh D-positive (Duan *et al.*, 2023; Owaidah and Yamani, 2023). Therefore, it is crucial to include molecular testing into clinical practice to maximize maternal-fetal health outcomes and transfusion safety. The prevalence of the Du antigen among Nigerian Rh D-negative blood donors is still little understood, despite its significance. Studies already conducted show that the frequency of Rh antigens vary by geography. For example, one study in Kano identified a 9.5% prevalence among patients with RhD, while another in Port Harcourt reported a 5% prevalence (Mazadu *et al.*, 2019; Awortu and Buseri, 2020).

Furthermore, a multi-ethnic survey conducted in Nigeria revealed a 92.7% prevalence of Rh D-positive people, underscoring the rarity of the Du antigen and the necessity of focused research on it (Adewoyin *et al.*, 2019). Similar studies are needed in Nigeria to improve donor management and transfusion safety, as evidenced by comparative statistics from other areas, such as Punjab's 0.07% weak D prevalence (Emily *et al.*, 2024). By lowering the danger of alloimmunization and guiding improved transfusion procedures, closing this knowledge gap could greatly enhance patient care.

Materials and Methods

Study Design and Setting

The University College Hospital (UCH) Blood Bank in Ibadan, Oyo State, Nigeria, served as the site of this cross-sectional investigation. Modern laboratory facilities and a sizable, varied donor base characterize UCH, a tertiary healthcare institution.

Study Design

Fifty Rh D-negative blood donors who were verified by routine serological blood typing techniques were included in the study. Clinical

and demographic information was gathered through the use of standardized questionnaires.

Sample Size Determination

Convenience sampling was used to choose a sample size of 50 donors, guaranteeing the inclusion of qualified Rh D-negative people who fulfilled the study's requirements.

Study Subjects

Inclusion Criteria

- Donors aged 18-65 years.
- Confirmed Rh D-negative donors.
- Individuals who provided informed consent to participate in the study.

Exclusion Criteria

- Recent history of blood transfusion or pregnancy.
- Donors with indeterminate or Rh D-positive status.
- Donors on medications that could interfere with antigen-antibody reactions or blood typing accuracy.

Materials and Equipment

The study utilized Anti-D serum, Coombs (anti-human globulin) reagent, centrifuge, test tubes, saline solution, microscope, incubator, and control cells (Rh-positive and Rh-negative).

Ethical Consideration

Ethical approval was obtained from the Oyo State Ministry of Health Research Ethics Committee (HREC). All participants provided written informed consent before inclusion in the study.

Clinical Laboratory Investigation

Sample Collection and Analysis

Using a conventional venipuncture, blood samples were obtained. After being collected, the samples were processed and subjected to the tube method for Du antigen testing. This involved adding antiglobulin serum for increased sensitivity, washing to get rid of unbound antibodies, then incubating with anti-D reagent. Samples were examined for agglutination both macroscopically and microscopically.

Statistical Analysis

SPSS version 25 was used for data analysis. Chi-

square tests evaluated correlations between variables, including age, gender, and Du antigen prevalence, while descriptive statistics compiled

clinical and demographic features.

Results

Table 1: Socio-demographic Characteristics of the Participants

Variables	Frequency	Percentage
Age		
19	2	4.0
21-28	16	32.0
30-39	14	28.0
40-49	12	24.0
50-59	6	12.0
Gender		
Male	33	66.0
Female	17	34.0
Religion		
Christianity	19	38.0
Islam	24	48.0
Traditional	4	8.0
Others	3	6.0
Ethnicity		
Hausa	4	8.0
Igbo	5	10.0
Yoruba	41	82.0
Marital status		
Single	37	74.0
Married	13	26.0

Table 2: Blood Group, Rhesus, and Result of Du Antigen Test (N = 50)

Variables	Frequency	Percentage
Blood Group		
A	10	20.0
AB	3	6.0
B	11	22.0
O	26	52.0
Rhesus		
Negative	50	100.0
Result		
Negative (-)	47	94.0
Positive (+)	3	6.0
Du Antigen test		
No	50	100.0

The table shows that 52.0% of the respondents had their blood group to be O, 22.0% had their blood group to be B, 20.0% had their blood group to be A, while 6.0% had their blood group to be AB. Majority of the respondents (94.0%) had a negative result, while 4.0% had a positive result.

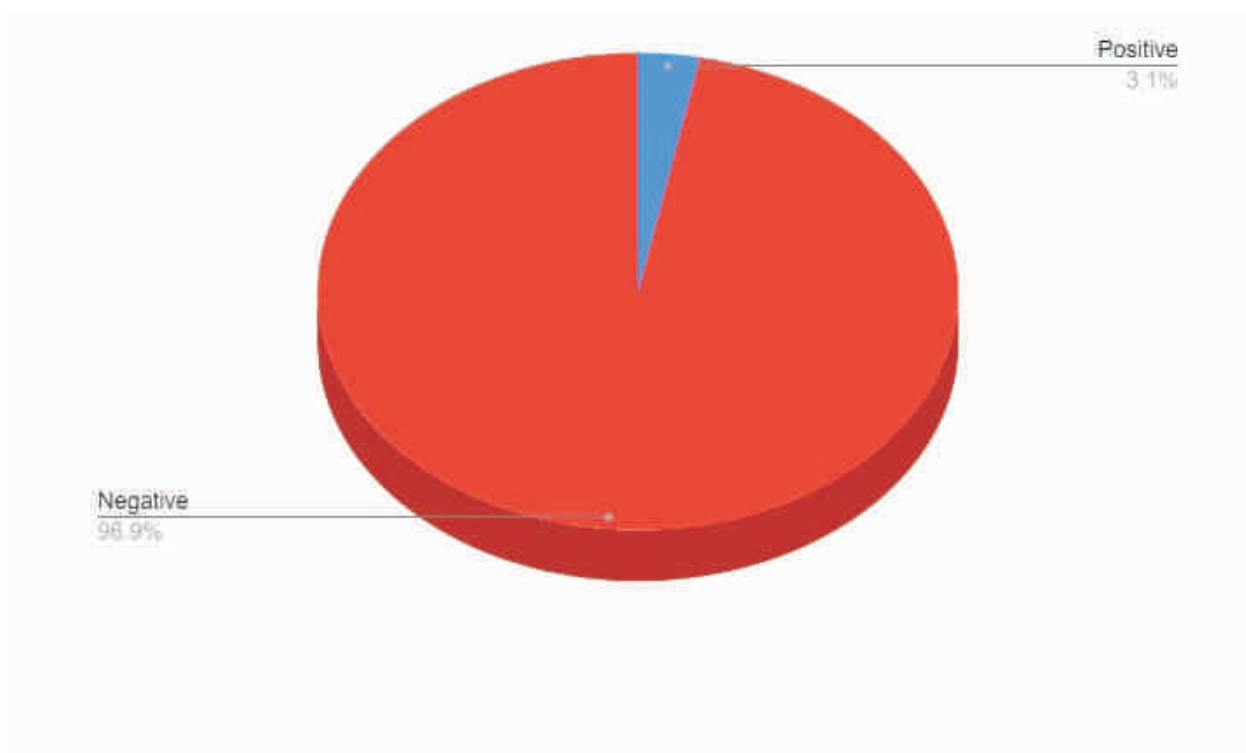


Figure 1: Pie Chart showing the Result of Du Antigen

Table 3: Transfusion, Pregnancies, and Medical Condition (N = 50)

Variables	Frequency	Percentage
Any previous transfusion		
No	32	64.0
Yes	18	36.0
Any previous pregnancies		
No	36	72.0
Yes	14	28.0
Any known medical condition		
No	50	100.0

It shows if respondents had any previous transfusion, pregnancies or any known medical condition.

Table 4: Relationship between Sociodemographic Factors and the Prevalence of Du Antigen among Rh D' Negative Donors

Variables	Result		X ²	P-value
	-	V		
Age			5	0.051
19	2	0		
21 - 29	16	0		
30 - 39	14	0		
40 - 49	11	1		
50 - 58	4	2		
Gender			2	0.464
Male	32	2		
Female	15	1		
Ethnicity			2	0.704
Yoruba	38	3		
Igbo	5	0		
Hausa	4	0		

The shows the result of the analysis revealed that there is a significant relationship between the age of respondents and prevalence of Du antigen ($X^2 = 5$, p-value = 0.051), and there is no significant relationship between gender ($X^2 = 2$, p-value = 0.464), and ethnicity ($X^2 = 2$, p-value = 0.704) and the prevalence of Du antigen among Rh D negative donors.

Discussion

This study sheds important light on the Du antigen prevalence among RhD-negative blood donors in a tertiary healthcare setting in Nigeria. In contrast to lower prevalence rates reported in European populations, the observed frequency of 6% is consistent with findings from other African studies and raises the possibility of regional or genetic factors (Erhabor *et al.*, 2013; Gwaram and Abdullahi, 2013; Adewoyin *et al.*, 2019; Etura *et al.*, 2020). More than 90% of Nigerians are Rh D-positive, according to available data, underscoring the particular difficulties presented by the Du antigen's poor expression in transfusion procedures (Afshan, 2013). The need for accurate antigen typing to reduce the danger of hemolytic illness and transfusion reactions is highlighted by the possibility that Du-positive persons could elicit immunological responses in RhD-negative recipients (Erhabor *et al.*, 2013; Gwaram and Abdullahi, 2013).

The strong correlation between age and the prevalence of Du antigen may be due to underlying genetic and immunological variables. Antigen-specific immune responses can be hampered by age-related changes in immunological responses, such as immunosenescence, which can result in decreased B and T cell activity, decreased cytokine production, and altered dendritic cell function (Farazi *et al.*, 2014; Wagner *et al.*, 2018).

According to genetic research, there may be age-dependent risk profiles for hereditary differences that affect immunological responses (Jiang *et al.*, 2020). These results call for more research into the ways that age-related mechanisms affect immunological responses and Du antigen expression. The lack of substantial correlations with ethnicity and gender, on the other hand, indicates that these demographic factors are less indicative of Du antigen status, highlighting the necessity of targeted research on age-related immunological dynamics (Cao *et al.*, 2021; Agrafiotis *et al.*, 2022).

For Rh D-negative blood donors to avoid alloimmunization and enhance transfusion compatibility, routine Du antigen testing is

essential. Even uncommon traits, as DEL variations, have been shown to confound transfusion techniques and require genetic testing for precise matching (Yin *et al.*, 2021). Strong Rh D typing methods are crucial because pregnant women who are sensitized are at a heightened risk of alloimmunization [22]. The convenience sample approach and single-site setting of this study are limitations that may limit how broadly the results may be applied. To offer thorough insights into the prevalence and clinical implications of the Du antigen, future studies should use multi-center designs and bigger, more varied cohorts (Crottet *et al.*, 2014; Savcheva *et al.*, 2024).

Conclusion

According to this study, among Rh D-negative blood donors at UCH, Ibadan, the Du antigen was present in 6% of cases. Age and Du antigen prevalence are significantly correlated, which emphasizes the necessity of focused donor management and transfusion procedures. To improve transfusion safety and guarantee precise Rh typing, routine Du antigen testing is essential. The results of the study add to the increasing amount of data that supports the inclusion of weak D antigen detection in routine blood bank procedures. Healthcare professionals can reduce the danger of alloimmunization, maximize transfusion results, and enhance patient safety by filling in the gaps in Rh typing procedures. To better understand the mechanisms causing age-related variations in Du antigen prevalence and to develop recommendations for routine screening in a variety of population.

Recommendations

Future studies should concentrate on incorporating bigger and more varied donor populations from various geographical areas in order to improve blood donor management and transfusion safety. It is advised to conduct longitudinal research to monitor changes in the prevalence of Du antigen over time. Healthcare professionals should prioritize routine Du antigen testing for Rh D-negative patients and raise awareness about its significance among both donors and doctors. To inform the public about the value of Rh typing and routine blood donation, public health campaigns should be

created. To ensure consistency and best standards among blood banks, government organizations should also work with medical practitioners to create national guidelines for Du antigen screening and transfusion procedures. Together, these actions will prevent alloimmunization, increase transfusion compatibility, and improve patient outcomes in general.

Acknowledgement

We extend our gratitude to all the departmental members, medical staff, and donors who contributed to this study.

Conflict of Interest: Authors declare that they have no conflict of interest.

Source of Funding: The project was a non-funded project.

Authors' Contribution: All authors contributed to the study equally.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

References

Adewoyin, A.S., Lee, G.M., Adeyemo, T.A., Awodu, O.A. (2019). Rh and Kell blood group antigen prevalence in a multi-ethnic cohort in Nigeria: implications for local transfusion service. *Immunohematology*: doi: 10.21307/immunohematology-2018-011.

Afshan, N. (2013). Detection of Du Antigen in Rh Negative Blood Group Individuals. 2013.

Agrafiotis, A., Neumeier, D., Hong, K.L., Chowdhury, T., Ehling, R.A., Kuhn, R., *et al.* (2021). B cell clonal expansion is correlated with antigen-specificity in young but not old mice. *BioRxiv*: doi: 10.1101/2021.11.09.467876.

Awortu, Z.A., Buseri, F.I. (2020). Rh antigen and phenotype frequencies and probable genotypes for the four main ethnic groups in Port Harcourt, Nigeria. *Immunohematology*: doi:10.21307/

Immunohematology-2019-483.

Cao, L., Zhao, S., Lou, J., Zheng, H., Chan, R.W., Chong, M.K., *et al.* (2021). Differential Influence of Age on the Relationship between Genetic Mismatch and A(H1N1)pdm09 Vaccine Effectiveness. *Viruses*: doi: 10.3390/V13040619.

Crottet, S.L., Henny, C., Meyer, S., *et al.* (2014). Implementation of a mandatory donor RHD screening in Switzerland. *Transfusion and Apheresis Science*; **50(2)**:169-174. doi: 10.1016/j.transci.2014.02.011. Epub 2014 Mar 6.

Duan, H., Liu, J., Jiang, Z., Shi, X., Hu, Y. (2023). Noninvasive screening of fetal RHD genotype in Chinese pregnant women with serologic Rh D-negative phenotype. *Transfusion*: doi: 10.1111/trf.17545.

Emily, H.M., Charles, R.T., Bodo, B.B., Snehal, G.P., Mohammad, B. (2024). Genotyping for Weak and Partial D Rh Status to Optimize Usage of Limited Blood Supplies. *American Journal of Clinical Pathology*: doi: 10.1093/ajcp/aaqae129.404.

Erhabor, O., Erhabor, T., Adias, T.C., Polycarp, I.I. (2019). Distribution of Clinically Relevant Blood Group Antigens among Nigerians and the Management of Rhesus D Negative Pregnancies: Implications for Haemolytic Disease of the Foetus and Newborn and Haemolytic Transfusion Reactions. *IntechOpen*: doi: 10.5772/INTECHOPEN.90372.

Etura, J.E., Amaechi, R.A., Akpotuzor, J.O., Okoroiwu, H.U. (2020). Demographics of Rhesus Phenotype of Blood Donors in Calabar: A Case Study of University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria. *Advances in Hematology*: doi: 10.1155/2020/2659398.

Farazi, M., Cohn, Z., Nguyen, J., Weinberg, A.D., Ruby, C.E. (2014). Early-onset age-related changes in dendritic cell subsets can impair antigen-specific T helper 1 (Th1) CD4 T cell priming. *Journal of Leukocyte Biology*: doi: 10.1189/JLB.1A0114-066R.

Gavrovskaya, S.V., Sisoeva, E.A., Bessmeltsev, S.S., Sidorkevich, S. (2023). Using the method of molecular genetic typing to determine variants of the weak antigen D in the diagnosis of Rh-affiliation. *Kazan Medical Journal*: doi: 10.17816/kmj119540.

- Gwaram, B.A., Abdullahi, S. (2013). Prevalence of Rh Phenotypes among Blood Donors in Kano, Nigeria. *Journal of Medicine in the Tropics*: doi: 10.4314/JMT.V15I1.
- Jiang, X., Holmes, C., McVean, G. (2020). The impact of age on genetic risk for common diseases. *BioRxiv*: doi: 10.1101/2020.07.17.208280.
- Lamba, H.S., Kaur, K., Vij, A.S. (2017). Prevalence of Weak D (Du) in Blood Donors in a Referral Teaching Hospital. *International Journal of Medicine and Dental Science*: doi: 10.18311/IJMDS/2017/18841.
- Matzhold, E.M., Bemelmans, M., Polin, G.F., Körmöczy, M., Schönbacher, T., Wagner, T. (2024). Characterization of Novel RHD Allele Variants and Their Implications for Routine Blood Group Diagnostics. *Biomedicines*: doi:10.3390/biomedicines12020456.
- Owaidah, A.Y., Yamani, L.Z. (2023). Misclassification of Rh D variants among pregnant women: a systematic review. *Journal of Medicine and Life*: doi: 10.25122/jml-2023-0004.
- Savcheva, M., Ivanova, S., Semerdzhieva, N.E., Chaneva, M., Atanasova, V.P., Bashev, N., *et al.* (2024). Perioperative selection of blood and components for substitution: Immunohaematological assessment of immunization risk and methods for selection of optimally compatible blood. *Pharmacia*: doi: 10.3897/pharmacia.71.e136635.
- Sippert, E., Volkova, E., Rippee-Brooks, M., Denomme, G.A., Lee, C., Araojo, R., *et al.* (2024). DNA reference reagents for genotyping RH variants. *Journal of Molecular Diagnosis*: doi: 10.1016/j.jmoldx.2024.02.005.
- Taufiq Kyari Mazadu, Sakina Sani Buhari (2023). Prevalence of Rhesus D antigen among patients attending Wudil General Hospital Kano State, Nigeria. *Biological Science*: doi:10.55006/biolsciences.2023.3201.
- Tounsi, W.A., Lenis, V.P., Tammi, S.M., Sainio, S., Haimila, K., Avent, N.D., *et al.* (2022). Rh Blood Group D Antigen Genotyping Using a Portable Nanopore-based Sequencing Device: Proof of Principle. *Clinical Chemistry*: doi: 10.1093/clinchem/hvac075.
- Wagner, A., Garner-Spitzer, E., Jasinska, J., Kollaritsch, H., Stiasny, K., Kundi, M., Wiedermann, U. (2018). Age-related differences in humoral and cellular immune responses after primary immunization: indications for stratified vaccination schedules. *Science Report*: doi: 10.1038/S41598-018-28111-8.
- Yin, Q., Flegel, WA. (2021). DEL in China: the D antigen among serologic Rh D-negative individuals. *Journal of Translational Medicine*: doi: 10.1186/S12967-021-03116-6.

Citation: Alabi Raphael, Adeoye Aliyah Adesalewa, Amusan Festus Olatunbosun, Adesina Beatrice Eburn, Inegbenebor Sylvester Ehilenbalu, Akpan Richard Peter, Oniye Adesola Helen. Prevalence of Du Antigen among Rh D-Negative Blood Donors at University College Hospital, Ibadan. *Sokoto Journal of Medical Laboratory Science*; **10(1): 380–387**. <https://dx.doi.org/10.4314/sokjmls.v10i1.36>

Copyright: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.