PREVALENCE AND GENETIC ASSOCIATION OF ABO BLOOD GROUPS AND SICKLE CELL GENOTYPESAMONG ENTRY-LEVEL FEMALE STUDENTS IN A NIGERIAN UNIVERSITY: A CROSS-SECTIONAL STUDY.

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Abstract

Extensive research has examined ABO blood groups and sickle cell genotypes, genetic relationship between these two traits particularly among female university students, remain insufficiently explored. This study determined the prevalence and genetic association of ABO blood groups and sickle cell genotypes among first-year females at Olabisi Onabanjo University, Ago-Iwoye, Ogun State. Validated structured questionnaires (434) were analysed from 447 administered to consenting female respondents. Standard testing kits for blood genotypes were used to analyse individual blood samples. Descriptive and inferential (Pearson **chi-square and Cramer's V)** statistics were employed to interpret the collected data. The results revealed a prominent age distribution (339, 78%) of young students aged 13 to 19 years, with a lower awareness of ABO blood groups (127, 29.3%) compared to a higher awareness of sickle cell genotype (290, 67%). Most participants expressed willingness to be tested for ABO blood groups (325, 75.0%) and sickle cell genotypes (317, 73.2%), because majority do not know their blood groups (247, 57.0%) and sickle cell genotypes (271, 67.0%) during pre-test assessments. The most common blood group identified was O+ (205, 47.2%), and the most prevalent genotype was AA (335, 77.2%) among all tested groups. The genetic relationship showed no significant ($P > 0.05$) association between the two traits among first-year female students. Despite the high level of awareness regarding sickle cell genotype, many participants still lack knowledge of their own statuses. Therefore, ongoing sensitisation and testing are essential, especially for new female students entering the university environment.

Keywords: Blood genotype testing; Female undergraduates; Healthcare services, Sickle cell disease; Genetic counselling

Introduction

Blood is a distinct connective tissue that has key roles in the human body and comprises over 300 blood group antigens in one of its vital components known as erythrocytes. Expression of these erythrocytes' antigens gave rise to 48 blood group systems, driven by varying genes at different chromosomal locations (International Society of Blood Transfusion, 2025). However, the most clinically significant in transfusion medicine are the ABO and rhesus (Rh) blood group systems (Egesie et al., 2008). The ABO blood group system which is the number one on the list of blood group systems, is characterised by allelic variations in the ABO gene, which are influenced by two main antigens on red blood cells (RBCs) (Singh & Arora, 2018). These antigens, known as A and B antigens, are determined by the genetic inheritance from parents. Individuals with blood type A display the A antigen, while those with type B display the B antigen. Blood type AB has both A and B antigens, whereas type O lacks both. The presence of these antigens stimulates the production of antibodies against the antigens that are not present on an individual's red blood cells (Liu et al., 2024). Therefore, each pair of alleles is classified into four main blood groups, A, B, AB, and O, based on the antigens on the surface of their RBCs and the corresponding antibodies in the plasma (Rathish, 2025).

The Rhesus system (Rh) is another important method for classifying blood groups, which identifies the presence as positive (Rh+) or absence as negative (Rh-) of a specific protein in an individual's erythrocytes. Rh+ indicates the expression of the RhD antigen, while Rh- indicates its absence (Al-Kuran et al., 2023).

Both ABO and Rh blood groups are considered the most clinically significant because they are linked to many diseases, especially in women. This includes haemolytic disease of the newborn (HDN) caused by adverse reactions from incompatibility of Rh blood groups between mother and foetus during blood transfusion, from a donor whose blood type is not compatible (Anyiam et al., 2022; Slusher et al., 2025). Additionally, blood group systems are associated with most types of cancer and a high risk of cardiovascular diseases (Aga et al., 2025; Bruun-Rasmussen et al., 2023). The presence of ABO blood group antigens impacts the expression of particular genes or proteins involved in the development and progression of cancer. It involves the interactions between ABO antigens and particular carcinogens or pathogens, thereby influencing cancer development. For instance, research indicates that individuals belonging to blood group A might face an increase susceptibility to gastric cancer, whereas those with blood group AB could potentially have a reduced risk. Conversely, the O blood group is identified as a prognostic factor among patients diagnosed with gastric cancer (Yu et al., 2020). Notably, the risk factors for cardiovascular disease that may be specific to women include menopause, hypertensive disease of pregnancy and depression (Mehta et al., 2023).

Blood grouping holds critical importance in clinical practice, particularly for young women of reproductive age, where accurate typing is essential for safe pregnancy management and maternal health (Bahardoust et al., 2023; Pai et al., 2023). Intervention measures such as good health service delivery that ensures routine blood testing (Abegaz, 2021), awareness of blood group compatibility, counselling, and genetic testing are crucial for all female students in higher institutions.

Furthermore, in human blood, hemoglobin (Hb) genotype is a crucial indicator for predicting hemoglobinopathies. The normal hemoglobin genotype is HbAA, while abnormal variants include mutant hemoglobin S and C (HbS, HbC). In Nigeria, the most commonly encountered abnormal haemoglobin genotypes include HbAS, HbAC, HbSC, and HbSS (Ajayi et al., 2022; Yahaya et al., 2024). Sickle cell disease is an autosomal recessive genetic condition associated with the presence of sickle haemoglobin (HbSS), which mostly affects young females in Nigeria (Nwabuko et al., 2022; Adigwe et al., 2023). The lack of awareness, routine check-up and understanding of ABO blood group and genotype, as well as persistent increase in sickle cell among people particularly affecting females, poses a significant health burden. Therefore, there is need to investigate and assess the level of awareness and education to address the growing health concerns among female students. Hence, the scope of this study was narrowly focused on young female individuals who have recently gained admission into a representative Nigerian university in Ogun State. This is because, the entry female students will form base line population data for genetic counselling and testing, mitigation strategies against sickle cell disease and proper blood donation management.

This research will specifically address the most affected gender entering reproductive age with similar experiences and lifestyles, forming the basis for future research, especially in population genetics study (Duangchan et al., 2024) and tailored policy development. This scope will reduce confounding variables but will enhance the validity of the findings and the reliability of the research outcomes (Willie, 2024). Nevertheless, there is a lack of comprehensive data on the demographic distribution, prevalence of blood groups and sickle cell genotypes, and the connection between blood group genotypes and sickle cell anaemia in Ogun State, especially among newly admitted female students in higher education. This highlights the necessity of this investigation to identify at-risk individuals early, aiming to prevent the burden of sickle cell disease. Therefore, this study aimed to determine the prevalence and genetic relatedness of ABO blood groups and sickle cell genotypes among first-year female students at Olabisi Onabanjo University (OOU), Ago-Iwoye, Ogun State.

Materials and Methods

Description of the Study Site

The cross-sectional research was carried out at OOU, located in the city of Ago-Iwoye, Ogun State, Nigeria, at latitude 6.92348°N and longitude 3.8364°e. The university was founded in 1982 and comprises four campuses across different locations, including the main campus in Ago-Iwoye, Sagamu (latitude 6.8489°N, longitude 3.6574°E), Ibogun (latitude 47.983°N, longitude 7.0°E), and Ayetoro (latitude 7.012°N, longitude 3.03°E), as shown in Figure 1 below. The university has thirteen (13) faculties, including the Faculty of Agricultural Management and Rural Development (AGRICMRD), Agricultural Production and Renewable Resources (AGRICPRR), Engineering (ENGRG), Environmental Science (ENVSCI), Pharmacy (PHARM), Basic Medical Sciences (BMS), Clinical Science (CLINSCI), Arts (ARTS), Education (EDU), Business Administration and Management Science (FAMS), Science (SCI), Social Science (SOSSA), and Law (LAW).

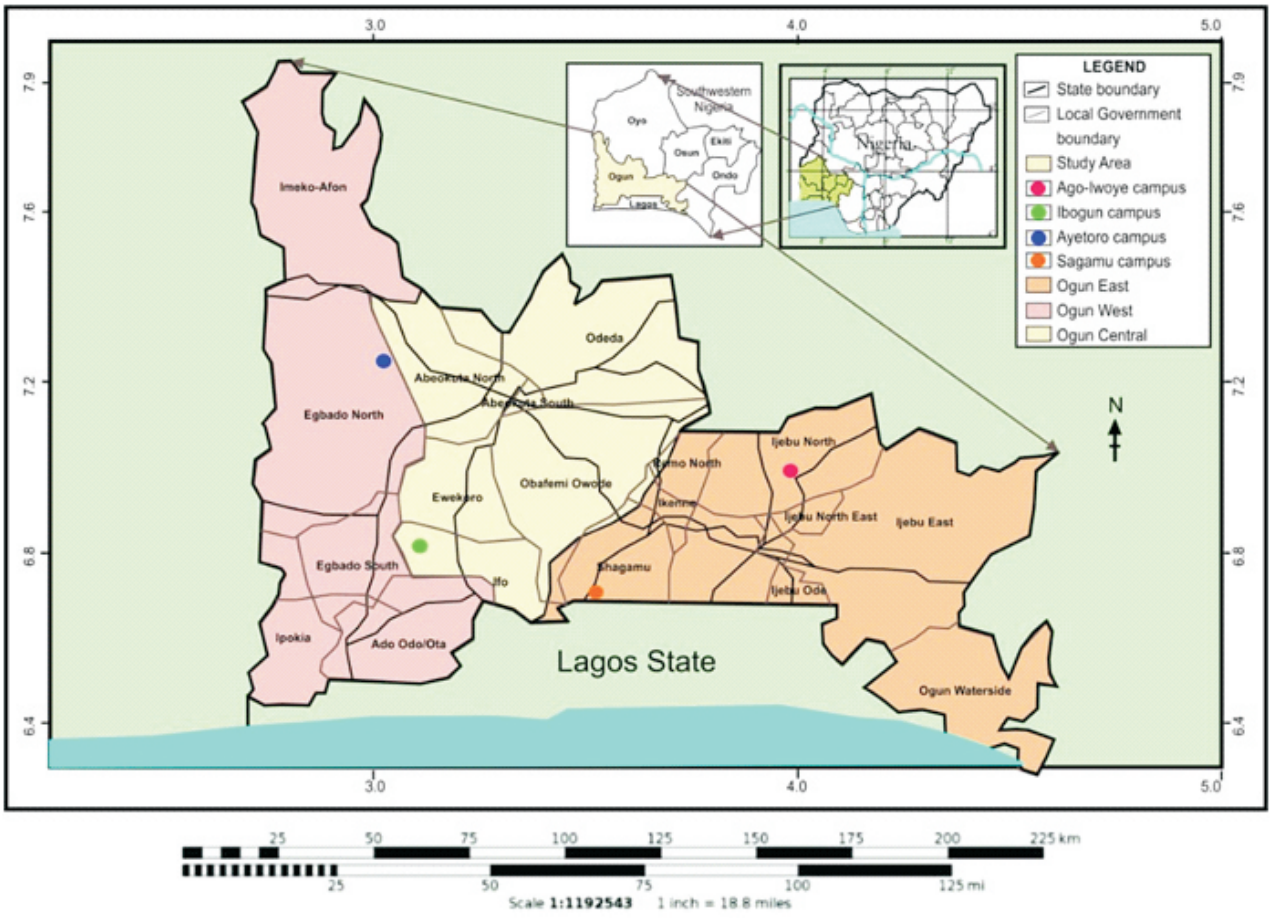


Figure 1: The map of study locations of all campuses in Olabisi Onabanjo University, Ago-Iwoye, Ogun state, Nigeria.

Study design

This cross-sectional study assessed prevalence and genetic relation of ABO blood group genotypes through self-administered questionnaires and voluntary blood testing among 447 newly admitted female students of Olabisi Onabanjo University. A non-probability purposive sampling technique was employed to recruit female entry-level respondents into the study. This choice was guided by the need to examine genetic traits within a homogenous cohort, thereby minimizing confounding effects attributable to sex-related biological differences. Entry-level students were specifically targeted because they represent a relatively unselected population, newly admitted into the university, and thus provide a more accurate reflection of the genetic diversity within the wider community. Unlike senior students, they are less likely to have been influenced by prolonged environmental exposures or selective attrition, making them an ideal group for cross-sectional genetic studies. Focusing on females of reproductive age further strengthens the clinical relevance of the study, as accurate blood grouping and sickle cell genotype determination are critical for maternal health, transfusion safety, and pregnancy outcomes. Although this sampling strategy limits generalizability to the broader student body, the scope of inference is explicitly defined, thereby avoiding selection bias and ensuring that findings are appropriately contextualized to the target population The sampling period targeted newly admitted female registered students scheduled for appointments to have their mandatory medical vitals taken at the institution's health centre. The study lasted five months, commencing on 6th of June 2024 and ended on the 7th of November, 2024 with institution ethical approval

Study instrument and validity

Developed structured questionnaires comprising of fifty-two (52) closed-ended and open-ended questions were validated via critical review and preliminary testing by Dr. Hakeem J. Edun from the Faculty of Education, ensuring that the questionnaires were accurate and suitable for research purposes. A total of four hundred and forty-seven (447) copies of the validated questionnaires were administered following the method described by Taherdoost (2022).

Study sensitization

Before filling out consent forms to participate and collecting blood samples (5 ml), a sensitisation exercise was conducted to actively engage the participants. The sensitisation was carried out at Olabisi Onabanjo University Medical Centre for all newly admitted female students. The students were **enlightened** and educated on the benefits of knowing their health statuses, as well as their roles in reducing the risk of having the sickle cell genotype and its implications for human health.

The sensitization exercises lasted for the duration of five months, which spanned from February to June, 2024.

Ethics, Consents and Confidentiality

The research was conducted in accordance with the Helsinki Declaration of 1975, as approved and revised in 2002 (available at the Helsinki Declaration of 1975), by the Health Research Ethics Committee of Olabisi Onabanjo University Teaching Hospital (OOUTH) (protocol code OOUTH/HREC/787/2024AP) on 20th May 2024. The voluntary participants were communicated about the relevance of the study and how truthful and reasonable answers were important when answering the questionnaire. No names were printed on the questionnaires and the respondents were assured of the confidential nature of the study. Consent was required before administration of the questionnaire. The written consent forms, which included study details on scope, methods, data collection, and processing, were provided to each participant. This was done voluntarily to ensure agreement, anonymity, data confidentiality, and the right to withdraw at any time without consequence throughout the study.

Calculation of the Proposed Population Size Using a Formula

The description by Yahaya et al. (2024), to determine **the sample size was employed** and the prevalence rate from Amoran et al. (2017) was used to calculate the formula shown below:

Sample size, $n = Z^2 p q/d^2$, where Z is the standard deviation set at 1.96, p (prevalence) = 0.5, q = 1-p, d (level of precision) = 0.05, and n = 384. A total of 434 female participants were analysed after cleaning and sorting from 447 questionnaires distributed in the study, which was well above the calculated sample size.

Eligibility criteria

The inclusion criteria comprised eligible medical records of entry-level female students enrolled at OOU who were present during the data collection period (June 2024 to November 2024). Only those who agreed to participate, as indicated in their questionnaires and consent responses. Additionally, those who may have missed their appointments but showed up for other days within the time frame of the study, were included in the study. However, female students not enrolled at the university, students who did not give consent, those absent during the sensitisation exercise and data collection, and records that were incomplete were excluded.

Sample collection, blood group, and genotype tests

Samples of blood (5 ml each) were hygienically collected strictly by certified laboratory scientists via venipuncture from the antecubital vein at the medical centre to test for both blood group and sickle cell genotypes. Out of 5 ml of blood sample collected, 3 ml were dispensed into 1.5 mg/mL ethylenediaminetetraacetic acid (EDTA). Each sample from respondents who consented was labelled with their laboratory numbers. A drop of each blood sample was placed alongside drops of anti-sera A, B, and D for rhesus factor (Rh) on a glass slide, gently mixed with an applicator stick, and the reactions were observed. The participants' ABO blood type and Rh factor were recorded based on agglutination with anti-sera A and B, and with anti-D serum, respectively. The occurrence of agglutination was marked as positive Rh (Rh+), while null or void clumping indicated Rh negative (Rh-) (Bando et al., 2020). Separately, the remaining 2 ml blood samples collected from each participant were analysed using standard phlebotomy techniques. Haemolysate was prepared by mixing the blood sample with a lysing agent to rupture erythrocytes and release haemoglobin. The cellulose acetate gel strip was immersed in an electrophoresis buffer solution (Tris-buffer citrate at pH 9.6) within the electrophoresis chamber (Uniscope SM 201 Surgifriend Medicals, England), with an electric current (0-20 Ampere) applied. The migration patterns of the participants' haemoglobin bands through the gel were compared with control samples to determine the haemoglobin genotype. Common haemoglobin variants include HbA, HbS, and HbC (Bando et al., 2020).

Statistics

Microsoft Excel 2016 and IBM SPSS version 23, released in 2015 (Armonk, NY: IBM Corp.), were utilised to scrutinise the collated records using both descriptive and Inferential statistical analysis. Descriptive data were presented as frequencies and percentages in charts and a table. A non-parametric, distribution-free test, chi-square ($\chi 2$), and Cramer's V were used to analyse the association between variables from the two test results at a 5% significance level.

Result

Demographic characteristics among entry-level female students in OOU.

Figure 2 presents the demographic characteristics of 100-level female students, including campus, faculty, and age. The campus distribution shows that the majority of female students are in the Main campus (Ago-Iwoye), comprising over 70% (324), followed by the three other campuses in Remo > Yewa > Egba. Among the 13 faculties, FAMS has the highest number of female students (20%), The age distribution indicates that most female undergraduates are in the 13-19 age bracket (339, 78%).

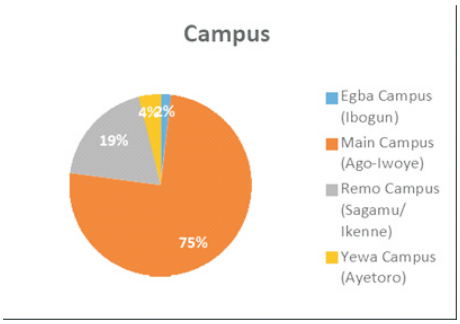
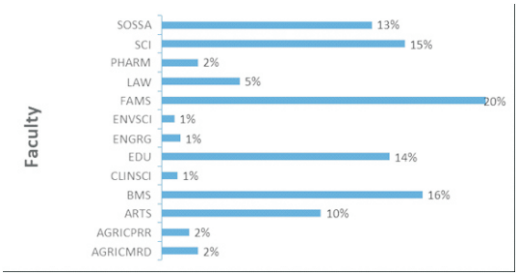


Figure 2a: Campus Distribution



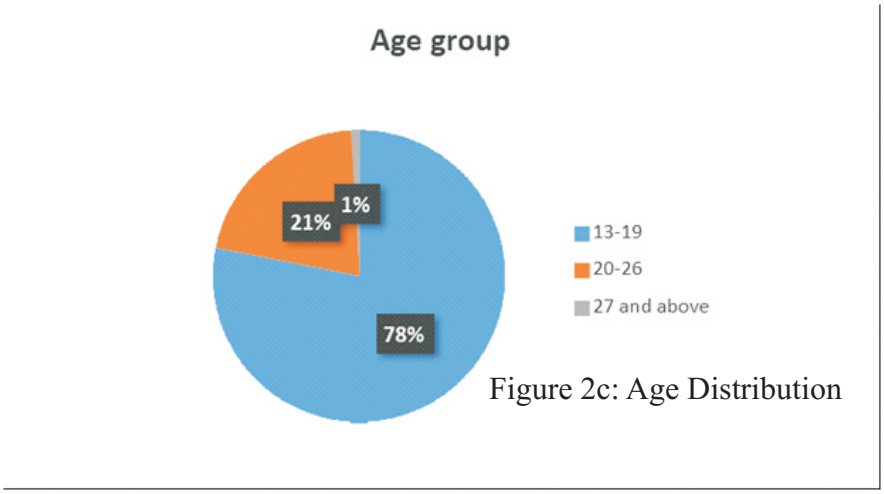
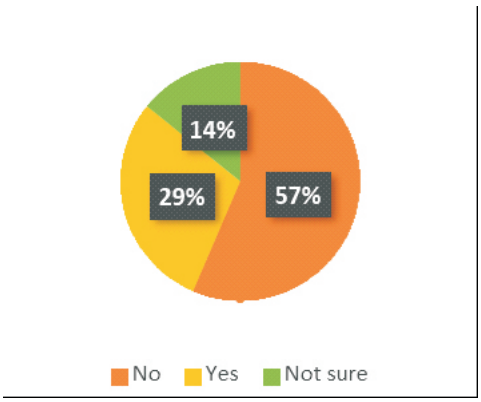


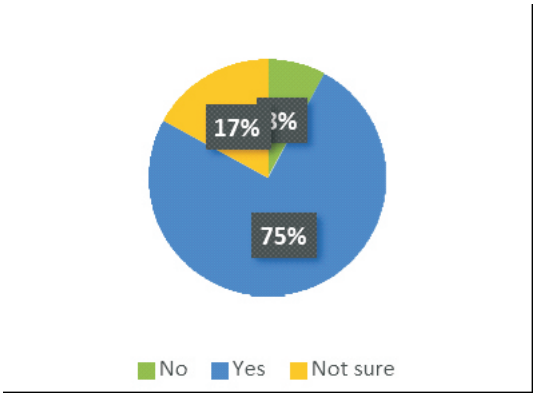
Figure 2c: Age Distribution

Figure 2: Demographic data of entry-level female students at OOU

The level of awareness and willingness to test ABO blood groups among entry-level female students at OOU.

Figure 3 demonstrates that over 50% of the 434 female undergraduates were unaware of their ABO blood group, while 29.3% (127) knew, and 14.3% (62) were uncertain about their knowledge. A significant proportion of the female participants (325, 75.0%) expressed willingness to test for the ABO blood group. However, fewer than 20% were unsure, and only 8% were unwilling to undergo testing for the ABO blood group.





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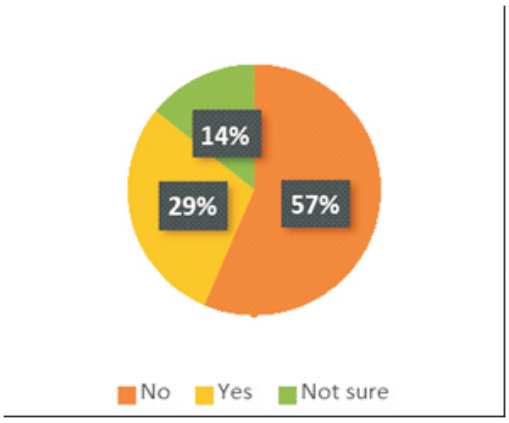

Figure 3a: Awareness of ABO

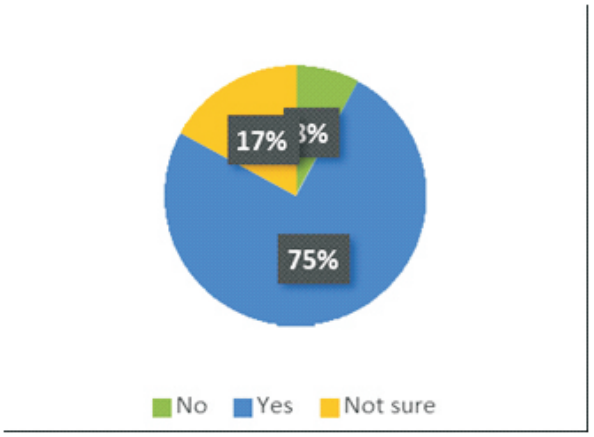

Figure 3b: Willingness for ABO test

Figure 3: Level of awareness and willingness to test for the ABO blood group

The level of awareness and willingness to test ABO blood groups among entry-level female students at OOU.

Figure 4 shows that a higher percentage of female students (290, 67%) were aware of sickle cell genotypes, while those who were not aware had a lower percentage (138, 32%). The majority of female students (317, 73%) at Olabisi Onabanjo University were willing to undergo testing for sickle cell genotypes. Additionally, 69 (16%) female students were uncertain, and 48 (11%) were unwilling to be tested for sickle cell genotypes.

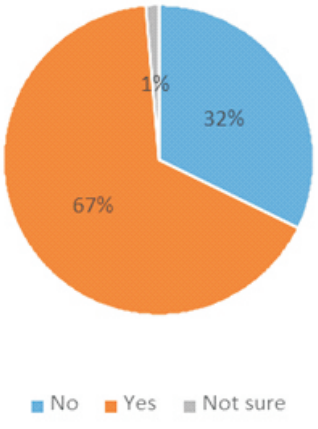

Figure 4a: Awareness of Sickle cell genotype

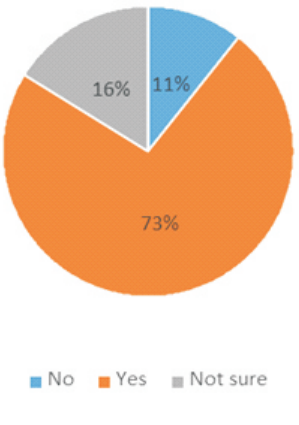

Figure 4b: Willingness for Sickle cell genotype test

Figure 4: Level of awareness and willingness to test for Sickle cell genotype

Prevalence of ABO blood group and sickle cell genotypes among entry-level female undergraduates at OOU in pretest and test results.

Table 1 shows that out of 434 participants analysed in this study, over 50% did not know their blood group genotype during the pretest screening. A higher percentage of students with pretest results was found in the O positive (O+) blood group (20.3%) compared to the other groups. The smallest percentages were recorded for A negative (A-, 0.2%), AB negative (AB-, 0.2%), and B negative (B-, 0.2%). Coincidentally, the test results confirmed a higher percentage of O+ (47.2%) among the students compared to other groups. However, the lowest percentages were recorded for both A- and B-, at 1.2% each, with no record of AB-. Table 2 indicates that both the pretest and test results for sickle cell genotypes showed high percentages of the AA genotype (40%; 77%), respectively. Interestingly, the percentages of the SS (0.9%) and SC (0.2%) genotypes remained not more than 1 from both pretest and test results.

Table 1: The Prevalence Percentage in Pretest Result and Test Result of ABO Blood Group

Pretest result of ABO blood group	**Frequency n (%)**	**Test result of ABO blood group**	**Frequency n (%)**
A negative (A-)	1 (0.2)	A-	5 (1.2)
A positive (A+)	77 (17.7)	A+	120 (27.6)
AB negative (AB-)	1 (0.2)	AB-	0 (0.0)
AB positive (AB+)	4 (0.9)	AB+	7 (1.6)
B negative (B-)	1 (0.2)	B-	5 (1.2)
B positive (B+)	32 (7.7)	B+	69 (16.0)
O negative (O-)	4 (0.9)	O-	23 (5.3)
O positive (O+)	88 (20.3)	O+	205 (47.2)
Not sure	226 (52.0)	Not sure	N/A
Total	**434 (100)**	**Total**	**434 (100)**

Table 2: The Prevalence Percentage in Pretest Result and Test Result of Sickle Cell Genotypes

Pretest result of sickle cell genotypes	**Frequency n (%)**	**Test result of sickle cell genotypes**	**Frequency n (%)**
AA	174 (40.0)	AA	335 (77.2)
AS	39 (9.0)	AS	89 (20.5)
AC	4 (0.9)	AC	5 (1.2)
SC	1 (0.2)	SC	1 (0.2)
SS	4 (0.9)	SS	4 (0.9
Not sure	212 (48.8)	Not sure	NA
Total	**434 (100)**	**Total**	**434 (100)**

Genetic correlation between ABO blood groups and sickle cell genotypes among entry-level female students at OOU.

Table 3 indicates that the AA genotype is the most common across all blood groups, with the highest proportion in O-negative (O-) female participants at 86.2%. The SS and SC genotypes are the least frequent, with the lowest percentages. Notably, AB negative (AB-) individuals are absent in all genotypes. The chi-square test result revealed a non-significant statistical association between blood group and genotype. Nevertheless, a moderate strength of the association was exposed from Cramer's approximate significance of 0.44.

Table I: Genetic relatedness between ABO blood group and sickle cell genotypes amongst entry-level female undergraduates in OOU.

Test results of the ABO and Rhesus	Test results of sickle cell genotypes (%)					Pearson Chi-Square ($\chi 2$)	Phi/Cramer's V
	AA	AS	AC	SS	SC		
A positive (A+)	74.2	2.0	22.5	0.7	0.7		
A negative (A-)	28.6	14.3	57.1	0.0	0.0		
AB negative (AB-)	0.0	0.0	0.0	0.0	0.0		
AB positive (AB+)	75.0	0.0	25.0	0.0	0.0	0.440	0.440
B negative (B-)	85.7	0.0	14.3	0.0	0.0		
B positive (B+)	83.0	2.3	14.8	0.0	0.0		
O negative (O-)	86.2	0.0	13.8	0.0	0.0		
O positive (O+)	77.2	0.4	20.8	0.0	1.5		

P>0.05

Discussion

This cross-sectional study identified the demographic patterns, prevalence of prior knowledge (Pretest), testing, and genetic relatedness of ABO blood groups and sickle cell genotypes among new female bachelor's students at OOU. Such exploration is vital in health management for premarital and prenatal screening, genetic compatibility, disease diagnosis, and the selection of donors for blood transfusions or organ transplants (Sachan et al., 2025). Therefore, this research provides valuable insights into the genetic traits of this female group (study population), with significant implications for public health, genetic counselling, and blood donation services. It also underscores the importance of focused, localised demographic studies that offer high-resolution insights, which may be lacking in broader studies (Breen & Freehan, 2024).

Demographic findings revealed the highest percentage of young female tertiary students aged between 13 and 19 years. This youthful age group aligns with the distribution of blood group and haemoglobin phenotype assessments of university students in Nigeria, as reported in the literature (Okunbor et al., 2024). Although, predominantly from the main campus, where most faculties and the medical centre are located. The Faculty of Administration and Management Science (FAMS) had the highest number of females, while the lowest was recorded in Environmental Science (ENVSCI). The distribution of young female adults is consistent with a recent study by Sarpong et al. (2025), where the majority of emerging females in higher education displayed positive attitudes and willingness to participate in premarital screening exercises. Nevertheless, despite their openness to undergo screening in Nigeria, Adigwe et al. (2023) reported minimal levels of awareness. This is in agreement with our findings, as most of the female volunteers were unsure of their ABO and genotype statuses from pre-test results (prior knowledge).

Recent research has consistently demonstrated that blood group O is the most prevalent across Nigerian populations, while the least common are blood groups A, B, and AB (Yahaya et al., 2024). This prevalence pattern is also evident among female students studied in Ago-Iwoye, where blood group O remains predominant (O+ >?A+?>?B+ >?O- > AB+ > B- > A- > AB-). This may be due to its evolutionary benefits related to disease resistance, while blood group AB remains the least frequent. Although, individuals with blood type AB have been reported to be at risk of Acute Hemolytic Transfusion Reaction (AHTR) if they receive ABO incompatible blood, as they lack anti-A and anti-B antibodies and may not exhibit immediate symptoms of transfusion reactions (Panch & Montemayor, 2022). Even though, pockets of variations in the proportions of ABO phenotypes that have been recorded in some other African countries, like Tanzania (Vuhahula et al., 2023;) and Ethopia (Legese et al., 2021). However, the dominance of O blood group from this research, indicates the ready proximity in a University, which is valuable for blood transfusion to forestall ABO incompatibility.

Additionally, the study shows the highest prevalence of the positive Rhesus factor among O blood type females, while the lowest was recorded in the negative Rhesus of the AB blood group. This finding corroborates the prior study of Oladeinde et al. (2022), which indicated that most female students at Edo State University exhibited high levels of O positive and reduced levels of AB negative. The high prevalence of blood group O, particularly O+ (positive), as the universal donor blood type, is essential for ensuring a stable supply of well-matched blood in emergency situations (Tekli et al., 2024). These findings highlight the importance of efficient management of blood banks and donor recruitment campaigns. Additionally, they emphasise the need to maintain diverse and sufficient blood reserves to meet the needs of patients with different blood groups. Recent development has been drawing attention to O+ females, as they are the most common among gynaecological cancer cases affecting the reproductive systems (Aga et al., 2025). Notably, cervical cancer has been shown to constitute over one-third of newly diagnosed cancers in women globally (Zhu et al., 2024).

The study further revealed that the majority of the respondents did not know their haemoglobin genotype (Sickle cell) from the outcome of pre-test results. This finding aligns with similar studies by Ezenwosu et al. (2021), as most respondents were unaware of their genotypes. The implication of this is that poor knowledge of the disease among respondents may prevent them from taking appropriate preventive actions, making it difficult to seek suitable medical intervention. Additionally, the test results showed the HbAA genotype as the most common, with a significant proportion also exhibiting the HbAS genotype. Conversely, HbSS and HbSC genotypes have the lowest prevalence among the female undergraduates. This distribution highlights the high incidence of sickle cell traits in Nigeria, a country notably ranked among those with high rates of sickle cell disorder (Adesola et al., 2025). The lower prevalence of HbSS and HbSC genotypes is consistent with national trends, where these are associated with sickle cell disease (SCD). This may be due high mortality rate attributed to the condition compared to healthy genotypes with high survival rate, especially in an area with lack of modern medical care for SCD. Moreover, these genotypes present significant health challenges but are less common compared to HbAA and HbAS, as documented by Ally and Balandya (2023). Understanding these patterns is vital for genetic counselling, especially for individuals contemplating marriage and family planning. Such knowledge can guide informed health decisions and help reduce the transmission of sickle cell disease.

The study's results show no statistically significant link between blood groups and sickle cell genotypes among these female freshers at the university. This indicates that the distribution of the five sickle cell genotypes (AA, AS, AC, SS, and SC) does not vary significantly across the four different blood phenotypes (A, B, AB, and O) in this population. Interestingly, AB-negative (AB-) individuals were not found in any genotype group. This means that individuals with different ABO blood groups are equally likely to carry any of the sickle cell genotypes. Further analysis of the strength of association using Craver's V demonstrated a moderate or reasonable effect size, which remains meaningful despite the lack of statistical significance. The moderate effect size observed could be due to random variation. However, it underscores the potential clinical and epidemiological importance of exploring genetic associations between ABO blood groups and sickle cell genotypes in young women, particularly given the implications for maternal health, transfusion safety, and population genetics in Nigeria. Future research should therefore employ larger, multi-center cohorts and incorporate diverse demographic groups to validate the observed effect size and clarify whether the moderate association between ABO blood groups and sickle cell genotypes reflects a true genetic relationship or sample-specific variation.

Comparing these distribution patterns with other recent studies in Nigerian populations highlights the consistency of genetic traits across various regions and institutions (Okunbor et al., 2024). This reinforces the importance of comprehensive public health planning and resource allocation. Therefore, these consistent patterns suggest that genetic screening and awareness programmes could be standardised to effectively address common health challenges. Moreover, understanding the prevalence of precise blood group antigens within a specific population signify magnitude of offering valuable information to prospective mothers at risk of having a child with HDFN, particularly among young adults (Duangchan et al., 2024).

Regular medical screening tests of blood group and sickle cell genotype have been of great concern among youths especially female students (Adegbite & Akinola, 2021). This study is very important to safety and compatibility during blood transfusion, tailored treatment decisions towards the prediction of the likelihood of complications associated with sickle cell diseases, prevention and detection. The study of the trend of these screening tests among female students would serve to prevent serious health complications, guide treatment decisions, and promote public health by identifying and managinggenetic predispositions.

Universities are in a unique position to lead these initiatives by incorporating genetic education into their curricula, organising workshops, and providing resources to improve students' understanding of genetic health. Such educational efforts can play a key role in raising awareness and encouraging proactive health management among students.

Study Limitations

Despite the large sample size, the study was conducted at a single university in south-west Nigeria and could not include all undergraduates from other universities, which may limit the generalisability of the findings. Additionally, male students were not represented at all. Therefore, for future research to monitor patterns and obtain more comprehensive findings, larger study groups and broader geographical coverage should be included to expand the scope from cross-sectional to longitudinal studies.

Conclusion

In conclusion, the findings from this study, revealed that blood group O has highest frequency and blood group AB has the least. The study shows that majority of the respondents did not know their genotype level. Also, the low rate of the awareness among female students reflects the importance of performing regular blood typing and cross-matching tests at the university. This will prevent not only agglutination reactions that may occur during blood donation, but also diseases and save lives.The prevalence of sickle cell genotype in Nigeria is of public health concern and it will continue to be if care is not taken. The reduction in the prevalence of sickle cell genotype can be achieved through premarital genotype screening and counseling. Additionally, genetic counselling and testing for sickle cell genotypes should be available for all students, especially female students who are more at risk of bearing the burden of childbearing. Notably, the blood group of an individual does not determine the student's sickle cell genotype, as documented in this study.

Authors' Contributions

Salisu TF developed the idea, study design, and the first draft of the manuscript. Distribution of questionnaires and data entry were handled by Tanimowo DA. Sample collection and testing were conducted by Folorunsho JB and Osonuga OA. Yahaya TO and Olusegun GA sorted, cleaned, and analyzed the data. Interpretation of results and development of the second draft were carried out by Fagbayi TA and Bolarinwa KA. All authors participated in editing, revising, and approving the final draft of the manuscript.

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Competing Interest

All authors have no competing interests

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