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Original Research

Hematological Profile and Blood-Borne Virus Prevalence in Pregnant Women at a Tertiary Military Hospital, Lagos, Nigeria.

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Abstract

Background: Maternal haematological status and concurrent blood-borne viral infections play a crucial role in determining pregnancy outcomes. This study assessed haematological profiles and the prevalence of blood-borne viruses among pregnant women attending a tertiary military hospital over a four-year period.
Methodology: A retrospective cohort analysis was conducted using clinical records of 499 pregnant women who attended antenatal care at the 68 Nigerian Army Reference Hospital, Yaba, Lagos, Nigeria. Data on demographics, complete blood count, and serology for blood-borne viruses were extracted into a structured proforma. It was analysed using statistical package of social sciences (SPSS) version 29. Descriptive statistics were presented using tables and charts. Associations were tested, with statistical significance set at $p<0.05$.
Results: Participants had a mean age of 36 ± 2.3 years. Blood group O was most common 245(49.7%), with the least being AB blood group which accounted for 48(9.6%). Haematocrit was lowest in the third trimester (31.21 ± 4.1%, $p<0.001$), while 1st and 2nd trimester haematocrits were 33.49±3.4 and 31.73±3.1 respectively. Anaemia was significantly associated with primiparity ($p=0.04$), HIV infection ($p=0.03$), and the Hb AS genotype ($p=0.01$). HIV prevalence was 30 (6.0%) higher than that of hepatitis B 27(5.4%) and Hepatitis C 7(1.4%).
Conclusion: HIV prevalence (6.0%) was higher than hepatitis B and C, and primiparous women showed significant anaemia with low haematocrit values. These findings call for targeted nutritional support and strengthened antenatal screening for blood-borne viruses to improve maternal and fetal outcomes.

Keywords: Anaemia; Haematological Indices; Blood-borne viruses; Pregnancy; Haemoglobinopathies.

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Quick Response Code:

Introduction

Pregnancy induces physiological adaptations across all organ systems, most notably in the cardiovascular and haematological systems, to meet the increased metabolic demands of the mother and the developing fetoplacental unit. [1-2] Key haematological changes include expanded blood volume, reduced peripheral vascular resistance, physiological anaemia, mild leukocytosis, thrombocytopenia, and alterations in coagulation balance. [3-4] Without awareness of these normal shifts, clinicians may misinterpret laboratory results, potentially leading to unnecessary interventions.

In low-resource settings, undiagnosed health conditions and inadequate pre-pregnancy iron stores may amplify the impact of these physiological changes on maternal and fetal outcomes.[5] Alongside these challenges, blood-borne viruses (BBVs) particularly HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV) remain important contributors to maternal and perinatal morbidity and mortality.[6-8] These infections can compromise maternal health, bypass placental immune defenses to cause vertical transmission, and pose occupational risks to healthcare providers.[6]

HIV remains the most prevalent BBV in Nigeria and a leading driver of maternal morbidity and mortality, while HBV is also highly endemic and a major cause of chronic liver disease.[6-8] HCV, identified over three decades ago,[3,6] contributes significantly to global chronic liver disease, yet in Nigeria it is underdiagnosed, as routine antenatal screening rarely includes HCV testing.[6] Most HCV infections are asymptomatic, complicating prevalence estimates,[7] and although several maternal and intrapartum risk factors for vertical transmission have been described,[6-8] the overall risk remains lower than for HIV or HBV. The clinical impact of delivery mode and breastfeeding in noninfected mothers is generally considered minimal. [8-10]

Despite the burden of these conditions, there is a paucity of local data defining trimester-specific haematological reference values in pregnancy alongside the prevalence of BBVs. Existing Nigerian studies are limited in scope and often assess these issues separately, without integrating haematological adaptations and viral screening. This study addresses that gap by examining both haematological parameters and BBV prevalence in a military hospital population, with the aim of informing clinical decision-making and public health strategies to improve maternal and neonatal outcomes.

Materials and Methods.

Study Design and Setting

A retrospective cohort study was conducted at the 68 Nigerian Army Reference Hospital, Yaba (68 NARHY), Lagos, from January 2020 to December 2023. The 500-bed tertiary facility serves military and civilian populations, averaging 7,000 patient visits monthly. Services include specialist-led antenatal clinics, HIV care, routine BBV screening (HIV, HBV, HCV, syphilis), haemoglobinopathy testing, advanced diagnostics, and 24-hour emergency, obstetric, and neonatal intensive care.

Participants and Exclusion Criteria

Pregnant women at booking who completed both full blood count and BBV testing were included. Exclusions: incomplete records, chronic medical conditions (e.g., diabetes, hypertension, thyroid disorders, renal disease, asthma), anticoagulant therapy, gestational trophoblastic disease, miscarriage, ectopic or multiple pregnancies.

Specimen Collection and Laboratory Analysis

Haematology: 10 mL venous blood collected aseptically into Na/K_3-EDTA tubes, analysed for Hb, PCV, WBC, and platelet count using Sysmex KX-21 haematology analyser.

Blood Group & Rhesus: Determined via forward/reverse typing and antiglobulin testing for Rh-negative confirmation.

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BBV Testing: Additional 10 mL venous blood collected in plain bottles, centrifuged at 3000 rpm for 5 min. Serum tested for HBsAg and anti-HCV (latex rapid agglutination, Grand Medical Diagnostic, USA); positives confirmed with ELISA (Bio-Rad, France). HIV testing followed Nigerian national guidelines, with Western blot confirmation at the Human Virology Laboratory, 68 NARHY.

Data Collection and Analysis

Demographic and laboratory data were extracted from patient records using a structured proforma. Analysis used IBM SPSS Statistics v29.0. Continuous variables were summarised as mean ± SD; categorical variables as frequencies/percentages. Chi-square tested associations between categorical variables; continuous variables were compared across trimesters using parametric methods.

Ethical Considerations

Approval was obtained from the Health Research Ethics Committee, 68 NARHY (Ref: 68NARHY/EC/218). The study followed the Declaration of Helsinki.

Primary Outcomes

Prevalence of HIV, HBV, and HCV among participants. Trimester-specific means for Hb, PCV, WBC, platelets, blood group, Rhesus status, and haemoglobin genotype.

Results

A total of 515 case notes were reviewed, of which 499 met the inclusion criteria, yielding a retrieval rate of 96.9%. The mean age of participants was 36 ± 2.3 years (range: 18–45 years). The 30–34-year age group constituted the largest proportion (38.3%) (Figure 1).

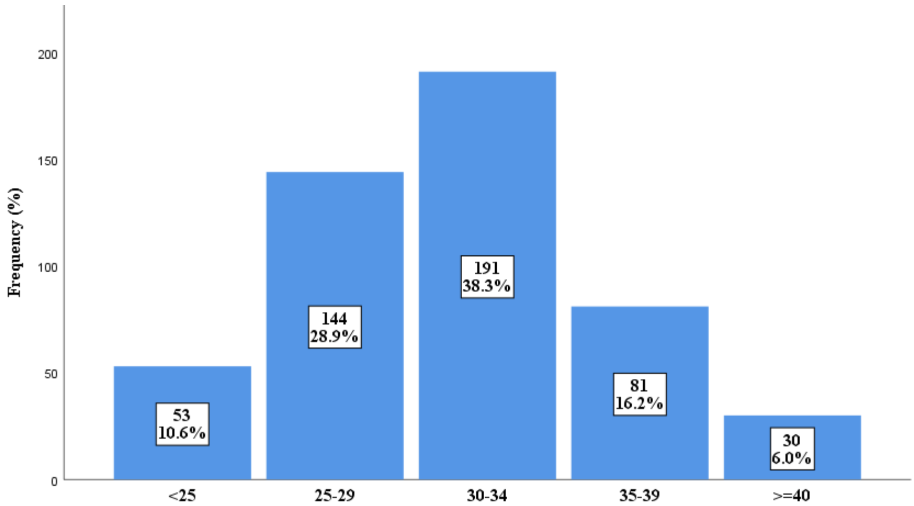

Figure 1- Age group of participants

Parity distribution is shown in Figure 2. The majority (50.5%) of the participants were multiparous.

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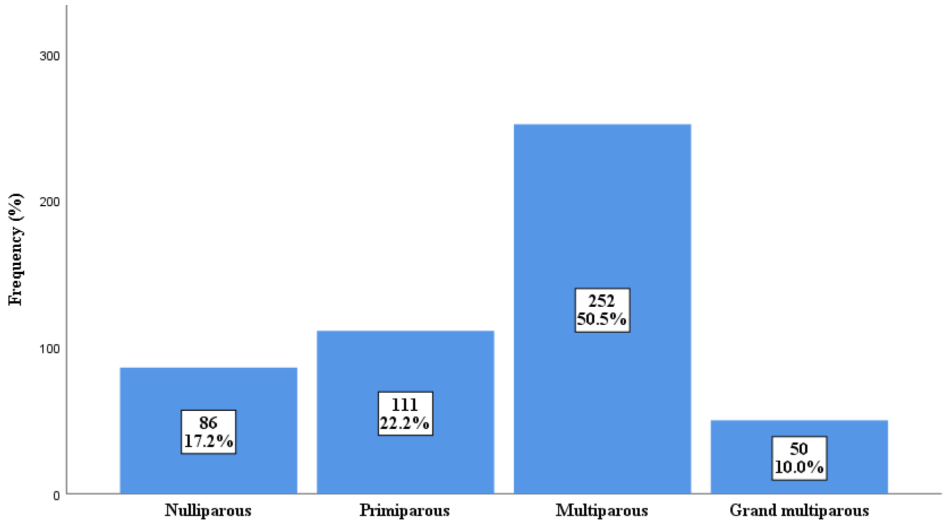

Figure 2- Parity distribution of the participants

Regarding haemoglobin genotype, the majority (90.2%, n=450) were Hb AA, while 3.4% (n=17) were Hb SS and 1.4% (n=7) were Hb AC (Figure 3).

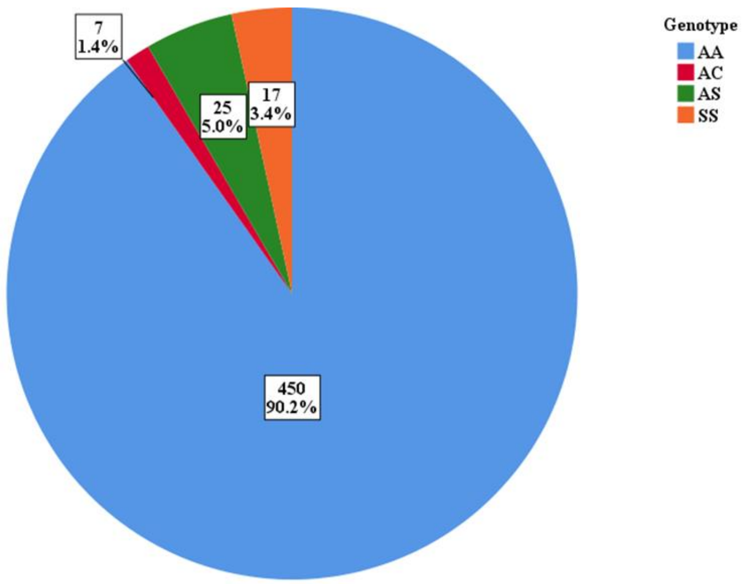

Figure 3- HB Genotype of our participants

Blood group distribution revealed that type O was most frequent (49.7%, n=248), followed by type A (28.5%, n=142). Type AB was least common (9.6%, n=48). Rhesus negativity was observed in 16% (n=81), most often in group O (54.3% of Rhesus-negative cases, n=44), and least frequent in group B (8.6%, n=7) (Table 1).

Table 1- Association between Rhesus factors and blood group

	n(%)	*Rhesus positive (n=418)*	*Rhesus negative (n=81)*	*p-value*
Blood group				
O	*245(49.1)*	*201(48.10)*	*44(54.32)*	*0.513*
A	*142(28.5)*	*121(28.9)*	*21(25.9)*	
B	*64(12.8)*	*57(13.6)*	*7(8.6)*	
AB	*48(9.6)*	*39(9.3)*	*9(11.1)*	

Mean haematological values by trimester were:

First trimester – Hb: 10.70 ± 1.2 g/dL; Hct: 33.49 ± 3.4%; WBC: 7.60 ± 1.9 × 10^9/L; Platelets: 246.70 ± 55.5 × 10^9/L.

Second trimester – Hb: 10.40 ± 1.1 g/dL; Hct: 31.73 ± 3.1%; WBC: 8.70 ± 2.4 × 10^9/L; Platelets: 245.31 ± 60.0 × 10^9/L.

Third trimester – Hb: 10.32 ± 1.1 g/dL; Hct: 31.21 ± 4.1%; WBC: 8.16 ± 2.2 × 10^9/L; Platelets: 241.59 ± 57.8 × 10^9/L. The comparison of the values is shown in Table. There was a significant difference between Haemoglobin and Haematocrit across trimesters with a significant P-value of 0.04*<0.001* respectively. The post-hoc analysis is shown in Table 3.

Table 2- Mean comparison of hematological indices according to trimester

	First trimester (Mean± SD)	*Second trimester (Mean ±SD)*	*Third trimester (Mean ±SD)*	*F-value*	*p-value*
Hb	*10.70±1.2*	*10.40±1.1*	*10.32±1.1*	*3.221*	***0.04****
HCT	*33.49±3.4*	*31.73±3.1*	*31.21±4.1*	*12.840*	***<0.001****
Platelet count	*246.70±55.5*	*245.31±60.0*	*241.59±57.8*	*4.845*	***0.008****
WBC	*7.60±1.9*	*8.70±2.4*	*8.16±2.2*	*11.937*	***<0.001****

F-value= Analysis of variance

Table 3- Post hoc analysis

	First vs second	*First vs third*	*Second vs third*
Hb	*0.014*	*0.087*	*0.701*
HCT	*<0.001**	*<0.001**	*0.459*
Platelet count	*0.814*	*0.005**	*0.005**
WBC	*<0.001**	*0.037**	*0.034**

Bloodborne virus screening showed HIV prevalence of 6.0% (n=30), HBV prevalence of 5.4% (n=27), and HCV prevalence of 1.4% (n=7). Co-infections included: HBV + HCV + HIV (0.6%, n=3), HBV + HIV (1.4%, n=7), and HCV + HIV (0.2%, n=1) (Table 4).

Table 4- Prevalence of Blood Borne Viruses

Variable	*Frequency (n=499)*	*Percentage*
HIV		
Positive	*30*	*6.0*
Negative	*469*	*94.0*
HBV		
Positive	*27*	*5.4*
Negative	*472*	*94.6*
HCV		
Positive	*7*	*1.4*
Negative	*492*	*98.6*
HBV and HCV co-infection	*3*	*0.6*
HIV and HBV co-infection	*7*	*1.4*
HIV and HCV co-infection	*1*	*0.2*
HIV, HCV, HBV co-infection	*3*	*0.6*

HBV- hepatitis B- virus, HCV- Hepatitis C virus, HIV- Human Immunodeficiency virus.

Multivariable analysis (Table 5) identified maternal HIV infection, high parity, and abnormal Hb genotype (Hb SS) as independent predictors of maternal anaemia.

Table 5- Association between anemia and selected characteristics

	Anaemia (n=326)	*Normal (n=173)*	χ^2	*p-value*
Age group				
<25	*32(60.4)*	*21(39.6)*	*2.129*	*0.712*
25-29	*90(62.5)*	*54(37.5)*		
30-34	*127(66.5)*	*64(33.5)*		
35-39	*57(70.4)*	*24(29.6)*		
≥40	*20(66.7)*	*10(33.3)*		
Parity				
0	*55(64.0)*	*31(36.0)*	*0.201*	***0.04***
1	*74(66.7)*	*37(33.3)*		
2-4	*165(65.5)*	*87(34.5)*		
>4	*32(64.0)*	*18(36.0)*		
HIV				

Positive	*21(70.0)*	*9(30.0)*	*0.307*	***0.03***
Negative	*305(65.0)*	*164(35.0)*		
HBV				
Positive	*14(51.9)*	*13(48.1)*	*2.290*	*0.130*
Negative	*312(66.1)*	*160(33.9)*		
HCV				
Positive	*5(71.4)*	*2(28.6)*	*0.117*	*0.733*
Negative	*321(65.2)*	*171(34.8)*		
Blood group				
A	*172(70.2)*	*73(29.8)*	*6.347*	*0.096*
B	*82(57.7)*	*60(42.3)*		
AB	*42(65.6)*	*22(34.4)*		
O	*30(62.5)*	*18(37.5)*		
Rhesus				
Positive	*272(65.1)*	*146(34.9)*	*0.076*	*0.783*
Negative	*54(66.7)*	*27(33.3)*		
Genotype				
AA	*293(65.1)*	*157(34.9)*	*5.650*	***0.01.***
AC	*2(28.6)*	*5(71.4)*		
AS	*19(76.0)*	*6(24.0)*		
SS	*12(70.6)*	*5(29.4)*		

Discussion

The majority of participants in this study were aged 30–34 years, with fewer women under 25 or over 40, reflecting barriers younger and older women may face in accessing formal healthcare. Most participants were multiparous, while nulliparous and grand multiparous women were underrepresented. This may reflect lower awareness among first-time mothers, complacency among grand multiparas, or improved adoption of family planning practices in Nigeria.

Haemoglobin genotype distribution was consistent with prior studies [1,2,16] Blood group O was most common (49.7%), followed by A (28.5%) and AB (9.6%), aligning with reports from different Nigerian ethnic groups [5] The high prevalence of haemoglobinopathies, particularly sickle cell disease, underscores the need for routine screening in pregnancy due to associated maternal and fetal complications.

Anaemia was observed across all trimesters with an overall prevalence of 65%. These findings align with prior reports [24,25] in Nigeria, where anaemia is multifactorial, influenced by nutritional deficiencies, infections (malaria, HIV), haemoglobinopathies, obstetric factors, and socio-cultural practices. Anaemia increases the risk of adverse outcomes, including postpartum hemorrhage, likely due to physiological changes in pregnancy such as increased cardiac output and reduced blood viscosity.

Screening for bloodborne viruses revealed HIV in 6%, HBV in 5.4%, and HCV in 1.4% of participants. Co-infections were rare. These results reinforce the importance of routine antenatal screening to reduce vertical and horizontal transmission. In particular, maternal HBV screening is critical as mother-to-child transmission contributes significantly to global HBV burden and can be mitigated through timely immunization.

Multivariable analysis identified maternal HIV status, high parity, and Hb SS genotype as independent predictors of anaemia. HIV may contribute to anaemia via bone marrow suppression, antiretroviral therapy effects, opportunistic infections, immune dysregulation, and reduced erythropoietin production. High parity depletes maternal iron stores and increases haemorrhage risk, further exacerbating anaemia, particularly in settings with short inter-pregnancy intervals.

Strengths and limitations

As this was conducted in a tertiary military hospital, the study population may not fully reflect the general pregnancy population in Lagos. Nonetheless, a key strength lies in the large sample size and the use of standardized laboratory protocols within a tertiary facility, which enhances reliability and internal validity. The retrospective design, however, limited control over potential confounders such as nutritional status, malaria parasitemia, and socioeconomic factors. Furthermore, the absence of trimester-matched non-pregnant controls restricts the ability to distinguish pregnancy-induced haematological changes from pre-existing patterns.

Conclusion

This study provides trimester-specific haematological values and BBV prevalence data for pregnant women in Lagos, Nigeria. Anaemia is highly prevalent and is independently associated with HIV, high parity, and Hb SS genotype. Targeted interventions, including routine haemoglobinopathy screening, nutritional supplementation, and universal BBV screening, are warranted to improve maternal–fetal outcomes. It Is recommended that multicenter, prospective studies including age- and parity-matched pregnant and non-pregnant women are needed to develop gestational age- and trimester-specific haematological reference ranges for the Nigerian population.

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