Ten-year review of feto-maternal outcomes of anaemia in pregnancy at a tertiary health facility in Southern Nigeria

Henry Odeyovwi Edehwosa[1], Innocent Okoacha*[2], Osamudia Okhionkpamwonyi[2], Edward Aimiehinor Akhator[2], Patrick Okonta[2]

[1]Delta State Hospital Management Board

[2]Delta State University, Abraka and Delta State University Teaching Hopsital, Oghara

Submitted: 13th May, 2025; Accepted: 29th June, 2025; Published online: 31st August, 2025
DOI: https://doi.org/10.54117/jcbr.v5i4.2
**Corresponding Author: Innocent Okoacha; innochi4life@gmail.com; +2348030856451*

Abstract

Anaemia in pregnancy remains a major global reproductive health concern, particularly in developing countries like Nigeria. This study assessed the prevalence, severity, and feto-maternal outcomes of pregnancy-related anaemia at Delta State University Teaching Hospital (DELSUTH), Oghara.

A retrospective descriptive study was conducted from 2012 to 2021. Records of pregnant women with anaemia (Hb <11 g/dL or PCV <33%) and complete outcome data were analyzed. Women with chronic medical/haematological conditions, or incomplete records were excluded. Data were extracted using structured forms and analyzed with SPSS v25. Chi-square and Fisher's exact (where appropriate) tests were applied, with bivariate analysis to test associations between anaemia severity and outcomes.

Out of 2,506 deliveries, 393 (15.7%) were anaemic. Of these, 326 cases with complete records were included. Most women were aged 31–40 years (42.9%), unbooked (58.6%), and had mild anaemia (63.5%). Severe anaemia (4.9%) was significantly associated with caesarean delivery (87.5%), blood transfusion (100%), postpartum haemorrhage (31.3%), sepsis (43.8%), prolonged stay in hospital (43.8%), and maternal mortality (31.3%) ($p < 0.001$). While severe anaemia was linked to low birth weight (37.5%) and macrosomia (31.3%), adverse fetal outcomes were more common in mild cases but not statistically significant. Haematinics were administered in 83.7% and blood transfusions in 16.3%.

Anaemia in pregnancy remains prevalent at DELSUTH. Severity is associated with poor maternal outcomes, highlighting the importance of early detection, improved antenatal access, and specialized institutional responses.

Keywords: Anaemia in pregnancy, fetomaternal outcome, antenatal care, DELSUTH, Nigeria

Introduction

Pregnancy-related anaemia continues to pose a significant reproductive health burden, particularly in developing nations like ours,

where it contributes substantially to increased maternal & perinatal morbidity and death**.** According to the World Health Organization (WHO), about 37% (approximately 32 million) of pregnant women aged 15 to 49 years are affected globally, with the highest prevalence in sub-Saharan Africa and South Asia (WHO, 2025). Anaemia affects maternal health, influences pregnancy outcomes, and it leaves lasting consequences for both the mother and her child.

The WHO defines anaemia in pregnancy as a haemoglobin level below 11.0 g/dL, with further classification into mild (10.0–10.9 g/dL), moderate (7.0–9.9 g/dL), and severe forms (<7.0 g/dL) (WHO, 2011). However, in many low-resource settings such as sub-Saharan Africa, a lower threshold of <10.0 g/dL is often adopted, based on earlier findings by Lawson (1967), which indicated that significant maternal and fetal complications typically arise below this level (Ajepe *et al,* 2020; Afolabi *et al*, 2023). Despite regional variations in diagnostic thresholds, the WHO classification remains the global standard.

Iron deficiency is the most common underlying cause of anaemia during pregnancy, responsible for approximately 50% of all cases. Other contributing factors include deficiencies in folate and vitamin B12, malaria, helminth infections, haemoglobinopathies, and chronic illnesses (Omote *et al,* 2020; Idowu *et al*, 2005). Haemodilution associated with pregnancy also lowers haemoglobin concentration, potentially exposing background nutritional deficits (Gandhi & Gupta, 2023).

In sub-Saharan Africa, anaemia prevalence among pregnant women ranges from 35.6% to 60%, depending on the region and study (Weze *et al*., 2020; Tirore *et al*., 2024; Fite *et al*., 2021; Waheeda *et al*.,2020). In Nigeria, the burden of anaemia during pregnancy is high. The 2018 Nigeria Demographic and Health Survey reported a national anaemia prevalence of 61% among pregnant women, with regional variations from 55% in the South-West to 71% in the South-East (Babah *et al*., 2025). These figures reflect a complex interplay of socio-economic inequity, poor nutrition, limited antenatal care, and endemic parasitic infections.

In Delta State, where the Delta State University Teaching Hospital (DELSUTH), Oghara, is located, anaemia in pregnancy continues to be a major concern. DELSUTH functions as a referral centre for managing complicated obstetric & gynaecological cases within the South-South region. Despite

ongoing antenatal interventions, clinical experience suggests that anaemia remains a leading contributor to adverse pregnancy outcomes (including low birth weight, preterm birth, fetal distress, perinatal mortality, postpartum haemorrhage, and maternal death).

Despite the magnitude of the problem, few institutional-based studies have evaluated the maternal and neonatal outcomes associated with anaemia during pregnancy in tertiary hospitals in southern Nigeria. The paucity of comprehensive local data hinders evidence-based policy formulation, optimal resource allocation, and focused clinical interventions. There is a need for robust hospital-based research to inform antenatal care strategies and improve outcomes.

This study was therefore conceptualized to fill this critical gap by conducting a ten-year retrospective review of feto-maternal outcomes associated with anaemia in pregnancy at DELSUTH, Oghara**.** Findings from this research will provide vital data to guide local clinical practice and contribute to ongoing discussions in maternal and reproductive health policies.

Aim of the study

To evaluate the feto-maternal outcomes of anaemia in pregnancy over a ten-year period at Delta State University Teaching Hospital, Oghara. Specifically, the it aims to estimate the prevalence, severity, and associated adverse outcomes of anaemia in our population.

Methodology

Case definition of Anaemia in Pregnancy

Anaemia in pregnancy was diagnosed based on the WHO-recommended threshold of haemoglobin levels below 11.0 g/dL. It was further classified into mild (10.0–10.9 g/dL), moderate (7.0–9.9 g/dL), and severe forms (<7.0 g/dL) (WHO, 2011).

Prolonged hospital stay was defined as more than three days following vaginal delivery or more than seven days post-caesarean section.

Study design

This study was a retrospective descriptive review of hospital records conducted to evaluate the feto-maternal outcomes associated with anaemia during pregnancy over a ten-year period. The names and hospital numbers of all hospital deliveries were retrieved from the labour ward, theatre and high dependency unit registers. This was used to retrieve case notes from medical records.

Study setting

The research was carried out in the Department of Obstetrics and Gynaecology at Delta State University Teaching Hospital (DELSUTH), Oghara, Delta State, Nigeria. DELSUTH is a tertiary healthcare facility that functions as a specialist referral centre for both primary and secondary health institutions within Delta State and adjoining states. The hospital offers comprehensive antenatal, intrapartum, & postnatal care, and maintains a robust medical records system.

Study population

The study population comprised all pregnant women who delivered at DELSUTH between January 1st 2012 to December 31st 2021, and were diagnosed with anaemia during pregnancy or labour.

Inclusion Criteria

- Pregnant women who delivered at DELSUTH within the study period.
- Documented haemoglobin level <11.0 g/dL during pregnancy or at delivery.
- Complete maternal and neonatal outcome records.

Exclusion Criteria

- Women with missing or incomplete medical records.
- Women with chronic medical conditions (HIV, TB, sickle cell crisis unrelated to anaemia, aplastic anaemia).
- Patients managed exclusively as referrals without delivery at DELSUTH.

Sample size and sampling technique

A total population sampling technique was used, including all cases that met the inclusion criteria within the ten-year review period. The total number of eligible anaemic pregnant women was determined from the labour ward and obstetric theatre delivery registers, antenatal records, and laboratory records.

Data collection

Information was collected using a standardized data collection form**.** Sources included delivery registers, antenatal clinic records, labour ward records, operative notes, case folders, and neonatal intensive care unit (NICU) records. Extracted variables included:

- Maternal variables: age, parity, booking status, gestational age at

delivery, haemoglobin level, mode of delivery, blood transfusion, complications (e.g., postpartum haemorrhage, sepsis), and maternal outcome (discharge or death).

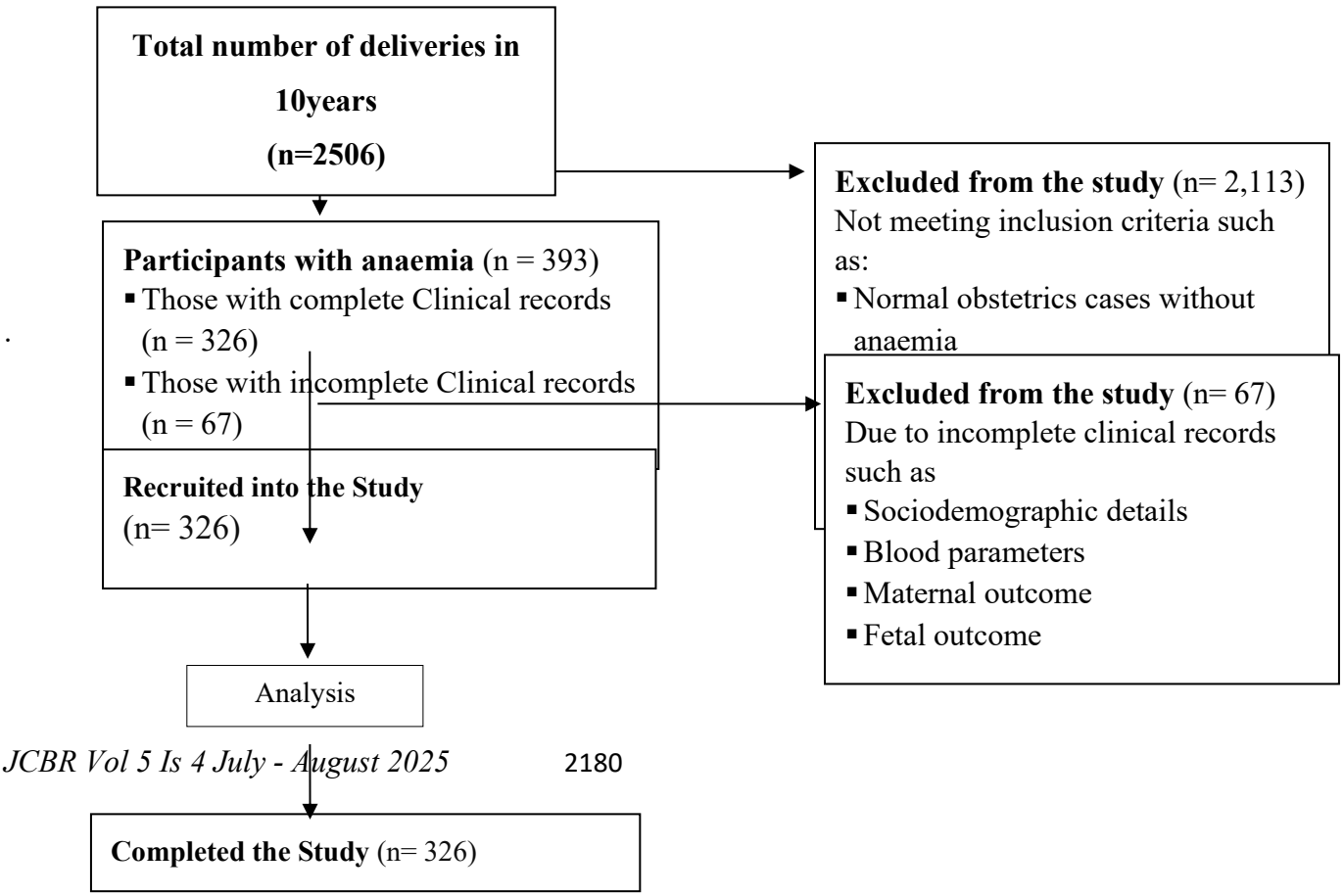
- Fetal variables: birth weight, Apgar scores, gestational age, admission to NICU, stillbirth, and early neonatal death.

Data analysis

The data were coded and analyzed with the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were applied to present the findings: categorical variables were summarized using frequencies and percentages, while continuous variables were expressed as means ± standard deviation. Bivariate analysis was conducted to examine the association between severity of anaemia and maternal and fetal outcomes, using Chi-square or Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee (HREC) of Delta State University Teaching Hospital, Oghara. Confidentiality was ensured by anonymizing patient information and restricting access to the data.



Results

Over the study period, a total of 2,506 deliveries were recorded, of which 393 cases were diagnosed with anaemia in pregnancy, yielding a prevalence rate of 15.69 per 100 deliveries. However, only 326 case files with complete data were successfully retrieved from the hospital's medical records department. The retrieval rate was 83%.

Table 1 shows the socio-demographic and obstetrics characteristics of the study participants. The majority were aged 31–40 years (42.9%), with a mean age of 31.04 ± 7.61 years. Educational attainment was generally low, with over half having no formal or only primary education. Most women were married (83.7%) and unbooked for antenatal care (58.6%). Multiparity was common, with 33.4% having parity between 2–4. Most deliveries occurred at term (76.4%), with a mean gestational age of 37.83 ± 3.05 weeks. Vaginal delivery was more common (57.4%), although a notable proportion (42.6%) had caesarean sections.

Table 1: Table showing socio-demographic and obstetrics characteristics

Characteristics		Frequencies	Percentages (%)
Age (years)	<20	26	8.0
	21-30	123	37.7
	31-40	140	42.9
	>40	37	11.3
	Mean ± SD	31.04 ± 7.61	
Educational level	No formal education	93	28.5
	Primary	99	30.4
	Secondary	74	22.7
	Tertiary	60	18.4
Marital Status	Single	53	16.3
	Married	273	83.7
Booking Status	Booked	135	41.4
	Unbooked	191	58.6
Parity	Para 0	67	20.6
	Para 1	86	26.4
	Para 2-4	109	33.4
	Para 5 and above	64	19.6
Gestational age	Preterm (<37weeks)	69	21.2
	Term (37-41weeks+6days)	249	76.4
	Post term (>42weeks)	8	2.5

	Mean ± SD	37.83 ± 3.05	
Mode of Delivery	Vaginal delivery	187	57.4
	Caesarean Delivery	139	42.6

Table 2 depicts the severity of anaemia among the study participants. The mean PCV of the participants was 31.04 ± 7.61%. It highlights that the majority of anaemic pregnant women had mild anaemia (63.5%) with a mean PCV of 27.0 ± 0.84, while moderate anaemia accounted for 31.6% (mean PCV 22.39 ± 2.23). Only 4.9% had severe anaemia (mean PCV 14.75 ± 2.08). Regarding treatment, haematinics were administered to 83.7% of women, while 16.3% required blood transfusions, typically in moderate to severe cases.

Table 2: Severity of Anaemia

Characteristics		**Frequencies**	**Percentages (%)**
Severity of Anaemia	Mild (PCV 27-29%)	207	63.5%
	Mean ± SD	27 ± 0.84	
	Moderate (PCV 19-26%)	103	31.6%
	Mean ± SD	22.39 ± 2.23	
	Severe (PCV 15-18%)	16	4.9%
	Mean ± SD	14.75 ± 2.08	
Method of Treatment	Haematinics	273	83.7
	Blood Transfusion	53	16.3

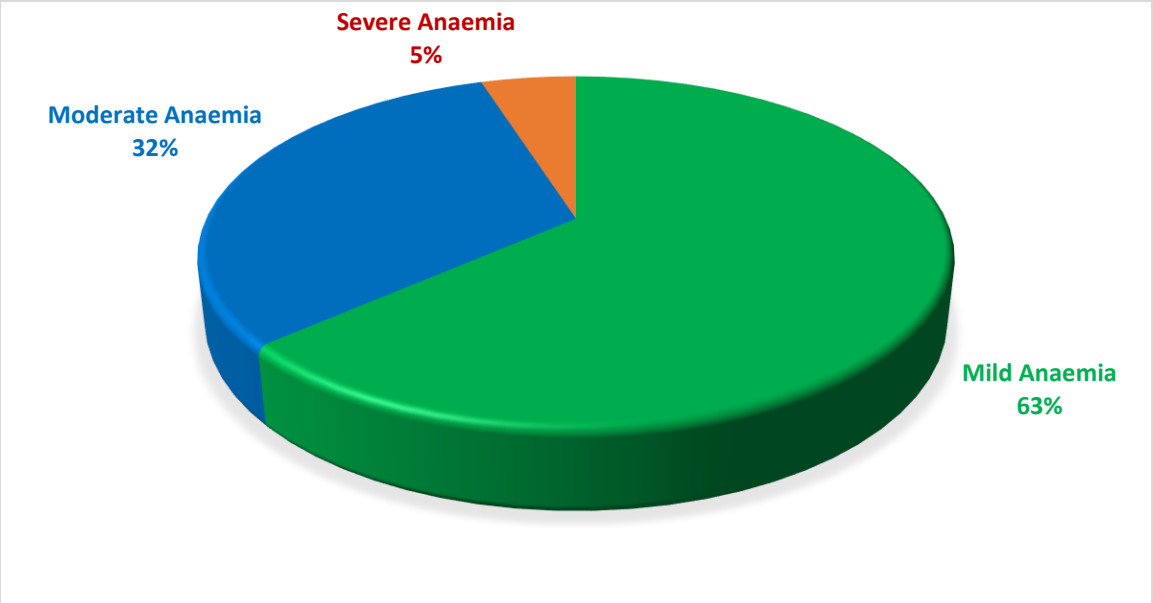


Figure 1: Pie chart showing the severity of anaemia

Table 3 compares anaemia severity with participants' socio-demographic and obstetric factors. Most women in all categories were aged 21–40 years. There was no statistically significant association between anaemia severity and age, education, marital status, booking status, parity, or gestational age ($p > 0.05$). However, significant associations were observed with mode of delivery and treatment ($p < 0.001$). Caesarean delivery was most frequent among women with severe anaemia (87.5%), compared to those with mild (41.1%) and moderate (38.8%) anaemia. All mild cases were treated with haematinics alone, while all severe cases required blood transfusion. Moderate cases received 64.1% haematinics and 35.9% blood transfusion.

Table 3: A comparison between the severity of anaemia with the socio-demographic and obstetrics characteristics of the study participants.

Characteristics		Mild	Moderate	Severe	χ^2	p-value
		n (%)	n (%)	n (%)		
Age (years)	<20	17 (8.22)	6 (5.83)	3 (18.75)	4.345	0.630
	21-30	78 (37.69)	39 (37.87)	6 (37.5)		
	31-40	86 (41.55)	48 (46.61)	6 (37.5)		
	>40	26 (12.57)	10 (9.71)	1 (6.25)		
Educational level	No formal education	59 (28.51)	29 (28.16)	5 (31.25)	1.703	0.945
	Primary	63 (30.44)	31 (30.1)	5 (31.25)		
	Secondary	46 (22.23)	26 (25.25)	2 (12.5)		
	Tertiary	39 (18.85)	17 (16.51)	4 (25)		
Marital Status	Single	33 (15.95)	20 (19.42)	0 (0)	3.877	0.144
	Married	174 (84.06)	83 (80.59)	16 (100)		
Booking Status	Booked	89 (43)	39 (37.87)	7 (43.75)	0.784	0.676
	Unbooked	118 (57)	64 (62.14)	9 (56.25)		
Parity	Para 0	46 (22.23)	18 (17.48)	3 (18.75)	7.284	0.295
	Para 1	54 (26.09)	27 (26.22)	5 (31.25)		
	Para 2-4	62 (29.96)	39 (37.87)	8 (50)		
	Para 5 and above	45 (21.74)	19 (18.45)	0 (0)		
Gestational age	Preterm	44 (21.26)	20 (19.42)	5 (31.25)	1.545	0.819
	Term	158 (76.33)	80 (77.67)	11 (68.75)		
	Post term	5 (2.42)	3 (2.92)	0 (0)		
Mode of Delivery	Vaginal Delivery	122 (58.94)	63 (61.17)	2 (12.5)	13.985	***<0.001**
	Caesarean Delivery	85 (41.07)	40 (38.84)	14 (87.5)		
Method of Treatment	Haematinics	207 (100)	66 (64.08)	0 (0)	151.857	***<0.001**
	Blood Transfusion	0 (0)	37 (35.93)	16 (100)		

Table 4: A comparison between the severity of anaemia with maternal outcome of the study participants

The table shows a strong association between the severity of anaemia and adverse maternal outcomes ($p < 0.001$). Postpartum haemorrhage occurred in 1.45% of mild cases, rising to 14.6% in moderate and 31.3% in severe cases. Puerperal sepsis was absent in mild cases but present in 5.8% of moderate and a striking 43.8% of severe cases. Similarly, prolonged hospital stays and maternal deaths increased with severity: both outcomes were absent in mild cases but occurred in 11.7% and 2.9% (moderate), and 43.8% and 31.3% (severe), respectively.

	Mild	**Moderate**	**Severe**	**χ^2**	**p-value**
	n (%)	**n (%)**	**n (%)**		
ADVERSE MATERNAL OUTCOME					
Postpartum haemorrhage	3 (1.45)	15 (14.57)	5 (31.25)	33.058	***<0.001**
Puerperal sepsis	0 (0)	6 (5.83)	7 (43.75)	75.577	***<0.001**
Prolonged hospital stays	0 (0)	12 (11.66)	7 (43.75)	61.095	***<0.001**
Death	0 (0)	3 (2.92)	5 (31.25)	60.723	***<0.001**

Table 5: A comparison between the severity of anaemia with fetal outcome of the study participants

A comparison of anaemia severity and fetal birth weight revealed that a greater proportion of women with severe anaemia delivered infants with low birth weight and macrosomia (37.5% and 31.3%, respectively). In contrast, those with moderate and mild anaemia were more likely to have babies with normal birth weights (35.9% and 34.8%, respectively). Interestingly, adverse fetal outcomes such as low APGAR scores, NICU admissions, and neonatal deaths were most frequent among women with mild anaemia (38.7%, 14.0%, and 7.3%, respectively), rather than in those with more severe forms. Despite these trends, the differences observed were not statistically significant.

Table 5: A comparison between the severity of anaemia with fetal outcome of the study participants

Characteristics		Mild	Moderate	Severe	χ^2	p-value
		n (%)	n (%)	n (%)		
Birth weight	Very Low Birth weight (<1kg)	21 (10.15)	10 (9.71)	2 (12.5)	2.474	0.871
	Low Birth weight (1-2.5kg)	62 (29.96)	33 (32.04)	6 (37.5)		
	Normal birth weight (2.6-4kg)	72 (34.79)	37 (35.93)	3 (18.75)		
	Macrosomia (>4kg)	52 (25.13)	23 (22.34)	5 (31.25)		
APGAR score	<7	80 (38.65)	34 (33.01)	3 (18.75)	3.098	0.212
	≥7	127 (61.36)	69 (67)	13 (81.25)		
NICU Admission	Admitted	29 (14.01)	12 (11.66)	2 (12.5)	0.341	0.843
	Not Admitted	178 (86)	91 (88.35)	14 (87.5)		
Neonatal death	Yes	15 (7.25)	6 (5.83)	1 (6.25)	0.227	0.893
	No	192 (92.76)	97 (94.18)	15 (93.75)		

NOTE: NICU; Neonatal intensive care unit

Discussion

This study assessed the socio-demographic characteristics, severity of anaemia, and its associated maternal and fetal outcomes among anaemic pregnant women at DELSUTH, a tertiary centre in South-South Nigeria. The findings reveal significant insights into how anaemia severity influences both maternal and neonatal outcomes, aligning with and expanding upon existing literature. A substantial proportion were unbooked for antenatal care (58.6%), which is consistent with other Nigerian studies that highlight the role of inadequate antenatal supervision in the persistence of anaemia and its complications (Ndukwu *et a*l., 2021)

The prevalence of anaemia in pregnancy at DELSUTH during the study period was 15.69%. This figure is notably lower than the 37.6% reported at Central Hospital, Warri (Omote *et al*, 2020), 65.1% in Enugu (Onyekpa *et al*., 2021), and 50.8% in Ghana (Wemakor, 2019). Such variations in prevalence may stem from different diagnostic modalities, as well as disparities in nutritional status and socio-economic conditions across study populations. The comparatively lower prevalence observed in our setting may indicate improved nutritional practices and better utilization of antenatal care. Moreover, as DELSUTH is a fee-for-service tertiary facility, its patients largely comprise individuals of higher socio-economic standing who may be less exposed to risk factors associated with anaemia in pregnancy.

Most participants were aged 31–40 years, with a mean age of 31.04 years, closely aligning with the mean age of 31.08 years reported in Rivers State by Alegbeleye *et al*., (2020). This age predominance may reflect the higher concentration of multiparous women within this age group. In contrast, studies from Anambra State (Chikwendu *et al*., 2015) and India (Suryanarayana *et al.*, 2017) found a higher prevalence of anaemia among younger women aged 20–29 and 21–30 years, respectively. These discrepancies may be attributed to differences in parity patterns, socio-demographic characteristics, and healthcare-seeking behaviours across the populations studied.

Multiparity and low educational attainment, both recognized determinants of poor maternal health outcomes in low- and-middle income countries, were associated with a higher prevalence of anaemia in this study. Specifically, 33.4% of anaemic women were multiparous, compared to 20.6% who were nulliparous. This aligns with findings from

Enugu (Oyekpa *et al*., 2019) and Benue (Anenga *et al.,* 2023), which reported increasing anaemia prevalence with higher parity. However, our findings differ from those in Anambra State (Chikwendu *et al*., 2015), where primigravidae were more affected. The increased anaemia burden among multiparous women in our study may reflect depleted iron stores from closely spaced pregnancies and inadequate nutritional replenishment. Multiparity, often associated with advancing maternal age, can result in cumulative nutritional deficits, particularly iron deficiency (Nonterah *et al*., 2019; Oyekpa *et al.*, 2021). Additionally, anaemia was more prevalent (71.5%) among women with only primary education or less. This finding corroborates studies from Benue (Anenga *et al*., 2023) and Kaduna (Onwuhafua *et al*., 2018), which demonstrated that women with secondary or higher education had lower anaemia risk. Educational attainment positively influences health-seeking behaviour, dietary choices, and adherence to antenatal care recommendations, thereby potentially contributing to the lower anaemia prevalence observed in this cohort.

In this study, the majority of anaemia cases were classified as mild (63.5%), followed by moderate (31.6%) and severe forms (4.9%). This distribution agrees with findings from Warri (Omote *et al*., 2020), Jos (Bassi *et al*., 2016), and Enugu (Oyekpa *et al*., 2019), which similarly reported a predominance of mild anaemia. However, it contrasts with the results from Jigawa State, where moderate anaemia constituted the majority (58.4%) of cases. The pattern observed in our setting may be influenced by the socio-economic context of DELSUTH, a fee-paying tertiary institution that caters to individuals with relatively better access to healthcare and nutritional support. As a referral centre, it offers improved antenatal services and early interventions that may mitigate the progression of anaemia. Notably, although mild anaemia was more common, severe anaemia was significantly linked with adverse maternal outcomes, including postpartum haemorrhage (31.3%), puerperal sepsis (43.8%), prolonged hospitalization (43.8%), and maternal death (31.3%). These findings reinforce global evidence on the dangers of severe anaemia and underscore the urgent need for prompt management, as evidenced by the universal requirement for blood transfusion in women with severe anaemia

Interestingly, while one would expect severe anaemia to be associated with poorer fetal outcomes, our study revealed a more

complex relationship. While low birth weight and macrosomia were more common in the severely anaemic group, other adverse neonatal outcomes such as low APGAR scores, NICU admissions, and neonatal deaths were surprisingly more frequent among those with mild anaemia. However, these differences were not statistically significant. This anomaly could be attributed to the higher number of women in the mild anaemia group and potential confounders such as undiagnosed comorbidities or intrapartum events. Some previous studies have also reported a non-linear relationship between anaemia severity and fetal outcomes, suggesting that mild anaemia may not always be protective (Lauer *et al*., 2024**)**

Furthermore, mode of delivery varied significantly with anaemia severity. Caesarean section was most common among women with severe anaemia (87.5%), possibly due to the need for expedited delivery to prevent further maternal deterioration. This finding aligns with other research indicating a higher likelihood of surgical intervention in high-risk pregnancies complicated by severe anaemia (Adam *et al.,* 2023}**.**

In terms of treatment, the use of haematinics in mild cases and transfusion for all severe cases highlight the necessity of early detection and intervention. Delayed or inadequate treatment contributes to poor outcomes, particularly in moderate to severe anaemia, as documented in related studies from sub-Saharan Africa **(**Ogbuju *et al*., 2025) This reflects a reliance on both preventive and corrective interventions within the facility to manage varying degrees of anaemia

Overall, the findings reinforce the pressing need for routine antenatal screening and effective management of anaemia in pregnancy. Improved maternal education, access to healthcare services, and availability of blood transfusion services are critical in mitigating the adverse outcomes associated with anaemia.

The study's limitations include its retrospective design, reliance on available medical records, potential data incompleteness, and lack of control for confounding variables influencing maternal and fetal outcomes.

Conclusion

This study highlights that anaemia in pregnancy remains a prevalent and clinically significant condition at DELSUTH, Oghara, with a prevalence rate of 15.7%. While most cases were mild, increasing severity of

anaemia was strongly associated with adverse maternal outcomes, including postpartum haemorrhage, puerperal sepsis, prolonged hospital stay, and maternal death. Caesarean delivery and blood transfusion rates also rose with severity. Although fetal outcomes did not show a consistent statistically significant association with anaemia severity, patterns suggest higher risks of low birth weight, NICU admission, and perinatal mortality in anaemic mothers. These findings emphasize the need for early identification, comprehensive antenatal care, and timely intervention for anaemia during pregnancy, particularly in resource-constrained areas. Routine screening, improved nutritional support, and enhanced health education must be prioritized. This study provides essential local data to inform departmental & institutional protocols and regional maternal health policies aimed at reducing anaemia-related morbidity and mortality in pregnancy.

Recommendation

This study highlights anaemia in pregnancy as a persistent challenge at DELSUTH, with severe forms significantly impacting maternal outcomes. We recommend strengthening antenatal screening, ensuring early intervention, and improving health education on nutrition. Subsidized antenatal care for vulnerable groups and routine haematinic supplementation should be institutionalized to reduce severity and improve fetomaternal outcomes.

Acknowledgements

We are grateful to all the participants, the staff of Obstetrics and Gynaecology department DELSUTH and the management of DELSUTH, Oghara.

Conflict of interest

The authors declare no conflict of interest

References

1. Adam I, Salih Y, Hamdan HZ (2023). Association of Maternal Anemia and Cesarean Delivery: A Systematic. Review and Meta-Analysis. J. Clin. Med.12, 490. https://doi.org/10.3390/jcm12020490
2. Afolabi BB, Ogunbode OO, Ezechi OC, Ogu RN, Agboghoroma CO, Aboyeji AP, Tukur J, Oyebode T, Daru PH, Oluwole AA, Onyebuchi A, Audu B, Aimakhu CO, Akinola O, Ikpeze OC, Sadauki HM (2023). Management and the Prevention of Anaemia in Pregnancy: SOGON Clinical Practice Guidelines. Tropical Journal of Obstetrics & Gynaecology.41(2); 64-69.
3. Ajepe AA, Okunade KS, Sekumade AI, Daramola ES, Beke MO, Ijasan O, Olowoselu OF, Afolabi BB (2020). “Prevalence and

foetomaternal effects of iron deficiency anaemia among pregnant women in Lagos, Nigeria," PLoS ONE, vol. 15, no. 1, p. e0227965.

4. Alegbeleye, J.O., Abam, D.S. and Orazulike, N.C. (2020). Outcome of Maternal Anaemia on Cord Haemoglobin of the Newborn in PortHarcourt, Nigeria. Journal of Biosciences and Medicines, 8, 142-152.https://doi.org/10.4236/jbm.2020.85014

5. Anenga UM, Rimamnunra GN, Eka PO, Agulebe CJ, Swende TZ, Maanongun MT, Akwaras NA, Ango JJ, Izeji R (2023). Prevalence and risk factors for anaemia among pregnant women attending antenatal clinic at Benue State University Teaching Hospital, North-central Nigeria. 26. 161-168. 10.29063/ajrh2022/v26i12s.17.

6. Babah OA, Sagastume D, Akinajo OR, Scarpa G, Hanson C, Larsson EC, Afolabi BB, Benova L (2025) Dietary diversity insufficiently explains differences in prevalence of anaemia in pregnancy across regions in Nigeria: A secondary analysis of Demographic and Health Survey 2018. PLOS Glob Public Health 5(5): e0004540. https://doi.org/10.1371/journal.pgph.0004540

7. Bassi AP, Idoko L, Dibigbo-Ibeaji NM, Adeniyi OG, Ramyil MS, Ogundeko TO, Pisagih JK, Offiah VN, Olorunfunmi JS, Amuta WE, Alu VO, Ajala EK, Olorundare OO (2016). Prevalence of Anaemia in Pregnancy Among Women Visiting Antenatal Clinic in Bingham University Teaching Hospital Jos, Nigeria. Clinical Medicine Research. Vol. 5, No. 3, pp. 52-62. doi: 10.11648/j.cmr.20160503.17

8. Chikwendu MC, Nkemena B, Udigwe GO, Obiechina NJA, Nnaji GA (2015). A Study of Risk Factors for Anaemia in Pregnancy at the First Antenatal Clinic Visit at Nnamdi Azikiwe University Teaching Hospital, Nnewi. Trop J Obstet Gynaecol, 32 (1), Pg 14-26

9. Fite MB, Assefa N, Mengiste B (2021). Prevalence and determinants of Anemia among pregnant women in sub-Saharan Africa: a systematic review and Meta-analysis. *Arch Public Health* 79, 219 (2021). https://doi.org/10.1186/s13690-021-00711-3

10. Gandhi MH, Gupta V (2025). Physiology, Maternal Blood. [Updated 2023 Apr 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557783/

11. Lauer JM, Bhaise S, Dhurde V, Gugel A, Shah M, Hibberd PL, Patel A, Locks ML (2024). Cohort Study in Eastern Maharashtra, India. Current Developments in Nutrition 8 104476. Pg 1-9

12. Ndukwu G, Dienye P, Adesokun B (2021). Obstetric factors associated with anaemia in pregnancy in a primary health center in south-south Nigeria. GSC Biological and Pharmaceutical Sciences, 14(03), 042–049. Article DOI: https://doi.org/10.30574/gscbps.2021.14.3.0028

13. Nonterah EA, Adomolga E, Yidana A, Kagura J, Agorinya I, Ayamba

EY, Atindama S, Kaburise MB, Alhassan M (2019). Descriptive epidemiology of anaemia among pregnant women initiating antenatal care in rural Northern Ghana. Afr J Prim Health Care Fam Med.10;11(1): e1-e7. doi: 10.4102/phcfm. v11i1.1892. PMID: 31038334; PMCID: PMC6489153

14. Ogbuju NE, Anoke UR, Olaiya PA, Wakama T, Okoro LC, Elebesunu EC, David EI, Okechukwu A, Jeremiah ZA (2025). Management of Anaemia during Pregnancy: Insights into Pathophysiology and Public Health Implications in Sub-Saharan Africa. Afr J Lab Haem Transf Sci,4(1): 58 - 68 DOI: https://doi.org/10.59708/ajlhts.v4i1.2510

15. Onwuhafua PI, Ozed-Williams IC, Kolawole AO, Zayyan MS and Adze J (2018). Prevalence of anaemia in the antenatal booking population at Ahmadu Bello University teaching hospital, Kaduna, Nigeria. Port Harcourt Med J. 2018; 12:44-8

16. Onyekpa IJ, Odugu BU, Onah LN (2021). Prevalence of Anaemia and its Socio-Demographic Characteristics among Pregnant Women Attending the Antenatal Booking Clinic in Esut Teaching Hospital (Esuth), Enugu. J Med - Clin Res & Rev. 5(9): 1-8

17. Omote V, Ukwamedua H, Bini N, Kashibu E, Ubandoma J, Rayang A (2020). Prevalence, Severity, and Correlates of Anaemia in Pregnancy among Antenatal Attendees in Warri, South-Southern Nigeria: A Cross-Sectional and Hospital-Based Study. Anemia. 1915231: 1–7

18. Suryanarayana R, Chandrappa M, Santhuram AN, Prathima S, Sheela SR (2017). Prospective study on prevalence of anemia of pregnant women and its outcome: A community-based study. J Family Med Prim Care; 6:739-43

19. Tirore LL, Areba AS, Tamrat H, Habte A, Abame DE (2024) Determinants of severity levels of anemia among pregnant women in Sub-Saharan Africa: multilevel analysis. *Front. Glob. Womens Health* 5:1367426. doi: 10.3389/fgwh.2024.1367426

20. Waheeda SK, Kara1, Jonathan C, Magafu M, Mzigaba JM, Fabian PM (2020). Anaemia in pregnancy in Southern Tanzania: Prevalence and associated risk factors. African Journal of Reproductive Health. September. 24 (3):155. DOI: 10.29063/ajrh2020/v24i3.17

21. Weze K, Abioye A, Obiajunwa C, Omotayo M. (2020). Spatio-temporal trends in anemia among pregnant women, adolescents and preschool children in sub-Saharan Africa. Public Health Nutrition. 24. 1-38. 10.1017/S1368980020004620

22. Wemakor A (2019). Prevalence and determinants of anaemia in pregnant women receiving antenatal care at a tertiary referral hospital in Northern Ghana. BMC Pregnancy Childbirth.11;19(1):495. doi: 10.1186/s12884-019-2644-5. PMID: 31829146; PMCID: PMC6907326

23. World Health Organization (2025). Anaemia. WHO, Geneva, Switzerland. https://www.who.int/news-room/fact-sheets/detail/anaemia

24. World Health Organization (2011). Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, Switzerland: WHO; 1-6. http://www.who.int/vmnis/indicators/haemoglobin