Socio-Demographic Factors and Health Behaviors as Predictors of Anemia Status Among Pregnant Women: A Cross-Sectional Study at a Regional Hospital in Ghana

Abstract

Introduction: Anemia is a significant public health concern, particularly among pregnant women in low- and middle-income countries. Despite the efforts to mitigate these risks, the prevalence of anemia remains high, and the factors contributing to this condition are poorly understood.

Aim: To assess the Socio-Demographic Factors and Health Behaviors as Predictors of Anemia Status Among Pregnant Women in Northern Regional Hospital, Tamale.

Methods: The study employed an analytical cross-sectional design. A total of 250 pregnant women attending antenatal care (ANC) at the Northern Regional Hospital were selected through simple random sampling. Data was gathered using a semi-structured questionnaire and analyzed with SPSS software. A significance level of p-value less than 0.05 was used to determine statistical significance.

Results: Most respondents (79.6%) knew the meaning of Anemia, 78.0% believed Anemia could be treated, and 83.2% indicated pregnancy was a high risk of Anemia. More than half of the respondents (59.2%) did not know their Anemia status, with 38.8% being pregnant. The study showed that education level (p=0.001), monthly income (p=0.047), employment status (p=0.009), age at first pregnancy (p=0.002), mode of delivery (p=0.003), and attendance at antenatal care (p=0.031) were significantly associated with anemia status. The study found that lower education levels (odds ratio 0.45, p=0.031) and a monthly income between GHS 500-1500 (odds ratio 0.47, p=0.048) were significantly associated with anemia in pregnant women, while self-employment (odds ratio 0.39, p=0.011) was associated with a lower likelihood of anemia compared to unemployment. Employment status showed a trend towards significance (p=0.053) but was not statistically significant.

Conclusion: The study found that while many pregnant women were aware of anemia and its risks, a significant portion was unaware of their anemia status. Lower education, income between GHS 500-1500, and self-employment were significantly linked to anemia. These findings highlight the need for targeted interventions and education, particularly for women with lower education and income. Improving antenatal care and preventive measures is crucial to addressing anemia in pregnant women.

Keywords: Anemia, Antenatal Care, Health Behaviors, Income, Pregnant Women, Socio-Demographic Factors

Introduction

Pregnancy is a profoundly transformative experience for women, characterized by the excitement of anticipating motherhood. However, this period can also bring immense sorrow when complications or unexpected circumstances endanger the pregnancy, potentially leading to serious health issues or even death [1]. One such condition that can overshadow the joy of pregnancy is anemia. As pregnancy progresses, the body's demand for iron increases, and anemia is defined by a hemoglobin level falling below 11.0 g/dl [2, 3]. Globally, approximately 500 million women of reproductive age suffer from anemia, with 29% of non-pregnant women and 38% of pregnant women between 15 and 49 years affected as of 2011. The highest rates of anemia are reported in South Asia and Central and West Africa, regions where iron deficiency is notably prevalent among pregnant women, contributing to 57.1% of anemia cases in developing countries [2].

Iron deficiency becomes a critical concern as pregnancy progresses, heightening the risk of anemia, with 57.1% of pregnant women in developing countries affected [2]. Anemia is responsible for approximately 3% of maternal deaths in Africa [5], and it impairs the body's ability to handle blood loss, increasing the risk of heart failure and other complications [6]. Worldwide, an estimated 56 million pregnant women suffer from anemia, affecting 41.8% of pregnant women globally. Rates vary significantly, ranging from just 5.7% in the United States to a staggering 75% in Gambia [7]. The condition remains a widespread issue, with around 500 million women of reproductive age affected globally, including 29% of non-pregnant women and 38% of pregnant women aged 15-49 years [4].

In low-income countries, nearly 50% of anemia cases are linked to poor nutrition, particularly due to inadequate iron intake [8]. Several factors, including rapid growth, dietary restrictions, and significant blood loss, increase the risk of developing anemia [9]. Variables such as age, ethnicity, number of pregnancies, and educational background also influence anemia prevalence in pregnant women [10]. Pregnancy-related anemia continues to be a major global public health challenge, especially in developing countries, where it contributes significantly to maternal morbidity and mortality, and heightens the risk of miscarriage, premature birth, stillbirth, low birth weight, and perinatal mortality [11]. In 2014, Ghana reported a 45% prevalence of anemia among pregnant women, with genetic, socio-demographic, and economic factors influencing its distribution, highlighting the need for targeted prevention strategies [12, 13]. To address this, the World Health Organization (WHO) recommends intermittent iron and folic acid supplementation for menstruating women in areas with anemia prevalence rates of 20% or higher, and daily supplementation for pregnant women as part of routine antenatal care [14, 15, 16].

In Ghana, the government has adopted the WHO's focused antenatal care model, which emphasizes individualized care, early detection of health issues, and intervention by skilled healthcare providers [15]. In the Tamale Metropolis, located in the Northern Region of Ghana, anemia among pregnant women attending antenatal care presents serious risks to both maternal and fetal health, including an increased likelihood of preterm births, low birth weight, and maternal mortality [17, 18]. Despite the efforts to mitigate these risks, the prevalence of anemia remains high, and the factors contributing to this condition are poorly understood. Yet, anemia in pregnancy continues to be a major issue in Northern Ghana and in the rise. This study investigates the knowledge, prevalence, and associated factors of anemia among antenatal care attendants at the Northern Regional Hospital. By identifying the level of awareness about anemia, its prevalence, and the socio-demographic, nutritional, and healthcare-related factors associated with it, the study seeks to provide data-driven insights that can inform targeted interventions to reduce the burden of anemia in this population.

Methods and material

Study setting

The study was conducted in the Northern Regional Hospital formally of Tamale Central Hospital. The hospital which is in the Tamale Metropolis in the Central Business Town of Tamale was established in July 1929 and is one of the key healthcare facilities in the Northern Region of Ghana. With a total of 186 beds spread across 8 functional wards, the hospital operates 24 hours a day to meet the needs of the community. It offers a variety of services, including outpatient care (OPD), pharmacy, antenatal care, laboratory services, surgical services, Ear, Nose, and Throat (ENT) care, psychiatry, and maintenance care, among others. In addition to these services, the hospital also provides specialized care and plays a crucial role in the region's healthcare delivery system. The hospital admits about 46,331 patients each year, with an average of 100 individuals seeking care daily. Patients typically stay for an average of 2 days, making the hospital a critical point of access for essential healthcare services in the region.

Study design

The study utilized a descriptive cross-sectional design with a quantitative approach. This type of study is observational, where the researcher simultaneously measures both the outcomes and exposures of participants at a single point in time [19]. This design was chosen because it enables data collection at a single point in time across two different locations, helping to identify potential differences between study variables and data from groups of various ages or developmental stages[20].

Study population

The study included pregnant women attending antenatal care (ANC) at the Northern Regional Hospital in Tamale.

Inclusion and exclusion criteria

The study includes pregnant women attending antenatal care (ANC) at the Northern Regional Hospital in Tamale, who are in any trimester of pregnancy and willing to participate with informed consent. Excluded from the study are women who are not currently pregnant (such as those post-delivery or non-pregnant), those with severe medical conditions or complications that prevent participation, and women who cannot communicate or understand the study's objectives due to language barriers or cognitive impairments.

Sample size and sampling technique

The sample size for this study was determined using the Taro Yamane (1967) method, based on an average monthly antenatal care (ANC) attendance of 708 at the Northern Regional Hospital, according to hospital data. N represents the entire population (708), whereas e is the margin of error, established at 0.05 (5%). The first computed sample size was approximately 255, utilizing this formula. A basic random sample approach was utilized for the sampling process. Pregnant women participating in antenatal care at the hospital were instructed to randomly draw a slip of paper from a basket bearing markings of "yes" or "no." Participants who selected "yes" were incorporated into the research, whilst those who selected "no" were eliminated. The technique was conducted daily until a sample size of 255 was attained. The simple random sampling procedure guaranteed that each pregnant woman had an equal probability of selection, so reducing selection bias and facilitating a representative sample.

Data Collection and Sampling Procedures

The sample size for this study was determined using the Taro Yamane (1967) formula, with the average monthly antenatal care (ANC) attendance at the Northern Regional Hospital recorded as 708. Applying a margin of error of 5% (0.05), the initial sample size was calculated to be approximately 255 pregnant women. To account for a 10% non-response rate, the final sample size was adjusted to 250 pregnant women attending ANC.

For the sampling technique, a simple random sampling method was employed to select participants. Pregnant women were asked to randomly select a piece of paper from a basket containing slips marked “yes” or “no.” Those who selected "yes" were included in the study, while those who picked "no" were excluded. This process continued until the desired sample size of 250 was achieved. The simple random sampling method ensured fairness and minimized selection bias, allowing each pregnant woman an equal opportunity to participate and ensuring a representative sample of the target population.

Data Collection Tool and Procedures

A structured questionnaire was used as the primary data collection tool for this study. The questionnaire was adapted and modified from previous studies[11, 12, 21] to align with the specific objectives of the research. The questionnaire was structured into four sections: Section A covered socio-demographic characteristics, Section B assessed the level of knowledge about anemia, Section C explored adherence to anemia treatment, and Section D focused on the prevalence of anemia among the participants. Most of the questions were close ended, designed to facilitate straightforward analysis, while a few open-ended questions were included to capture more nuanced insights.

To ensure clarity and cultural relevance, the questionnaire was translated into the local language of the respondents. This translation was vital to ensure that all participants fully understood the questions and could provide accurate responses. Additionally, cultural considerations were considered during the translation process to ensure that the questions were respectful and appropriate for the local context.

Data collection took place between March and April 2024. Enumerators were thoroughly trained on the study objectives, ethical guidelines, and the correct way to administer the questionnaire. This training emphasized the importance of accurate translation and the need for consistent interpretation to ensure reliable data. Before the main data collection, the questionnaire was pre-tested on a small sample of ANC attendants who were not part of the final study group. Feedback from this pre-test was used to refine the questionnaire, improving its clarity and relevance.

All participants provided informed consent prior to the commencement of data collection. Participants were apprised of the study's objective and guaranteed that their replies would be kept anonymous and confidential. This fostered confidence and promoted candid replies.

The data were collected in person at the antenatal care unit of the Northern Regional Hospital, where the questionnaires were administered face-to-face. Enumerators read out the questions and provided translations as needed to ensure full understanding. Responses were systematically recorded on structured forms. Supervisors closely monitored the data collection process to ensure that all procedures were followed correctly and that the data collected were accurate and complete. Any discrepancies were addressed immediately to maintain the quality of the data.

Data Management, Analysis, and Presentation

Data management and analysis were performed using IBM SPSS version 25. While the initial sample size was 255, five incomplete questionnaires were identified and excluded, leaving 250 valid responses for the analysis. The data were cleaned, sorted, and entered SPSS for processing. Descriptive statistics, including means, percentages, and cross-tabulations, were applied to summarize key findings. A chi-square analysis was conducted to assess the associations between dependent variables (such as anemia knowledge, adherence, and prevalence) and independent variables (such as age, education, and socioeconomic status). A p-value of less than 0.05 was considered statistically

significant. The results were presented in tables, charts, and graphs to provide a clear visualization of the findings and highlight any significant relationships between variables.

Ethical consideration

Approval to conduct the study was requested and obtained from the management of Northern Regional Hospital. The research complied with ethical standards for studies involving human subjects, according with the Declaration of Helsinki. Informed permission, both written and oral, was acquired from all participants after they received comprehensive information about the study's objectives, methodologies, and their voluntary involvement. Participants were guaranteed that their replies would be secret and their names would stay anonymous. They were also notified that they might exit the research at any moment without repercussions. The research adhered to all ethical norms throughout the procedure.

Results

Socio demographics characteristics of the respondents

Most are aged 20-29 years (43.6%), married (84.4%), and have no formal education (41.2%). A majority follow Islam (52.4%) and earn less than GHS 500 monthly (62.4%). Most live in households with fewer than four people (73.2%) and have unemployed spouses (65.6%). The educational level of spouses is mostly low, with 38.8% having no education (Table 1).

Obstetric characteristics

Most women had their first pregnancy between 20-24 years (44.8%), with 18.8% under 20 years, 29.2% between 25-29 years, and 7.2% at 30 or older. A majority had fewer than four pregnancies (58.4%) and fewer than three live births (48.4%). The majority were in their second trimester during their most recent pregnancy (43.6%), with 33.2% in the first trimester and 23.2% in the third. Most deliveries took place in hospitals (88.4%), and 84.4% had a spontaneous vaginal delivery (SVD), while 15.6% had a cesarean section (CS). The most common reasons for CS included being post-date (33.3%), having a big baby (17.9%), and complications like abruptio (23.1%). The vast majority (92.4%) attended antenatal care (ANC) during their recent delivery.

Knowledge of respondents on Anemia in pregnancy

The majority correctly identified anemia as a decrease in red blood cells or hemoglobin (79.6%), with smaller percentages linking it to viral infections (4.4%) or an increase in red blood cells (7.2%). Malnutrition (85.6%), malaria (75.6%), and acute or chronic blood loss (82.4%) were recognized as common causes of anemia, while fewer identified chronic illness (42%) or high parity (23.6%) as risks. The most common symptoms associated with anemia were paleness (97.2%), shortness of breath (77.6%), and physical weakness (80.4%). Most respondents believed anemia could be treated (78%) and that pregnancy posed a high risk for anemia (83.2%). Furthermore, a majority acknowledged anemia as a serious health concern for both mothers (86.8%) and unborn babies (73.6%). For prevention, eating an iron-enriched diet (86%), taking iron supplements (75.6%), and consuming fruits (82.8%) were the most common strategies. A significant number (59.2%) knew that sleeping under insecticide-treated nets (ITNs) could help, and 40.8% recognized that drinking tea, coffee, or milk after meals can reduce iron absorption (Table 4).

Prevalence of Anemia in pregnancy

Table 5 presents the prevalence of anemia among pregnant women. While 40.8% of respondents knew their anemia status, the majority (59.2%) did not. At registration, 41.6% had a hemoglobin level below 11g/dl (anaemic), while 58.4% were non-anaemic. At their current ANC visit, 38.8% were anaemic, and 61.2% had a hemoglobin level of 11g/dl or higher.

Associations between socio-demographic characteristics and current anemia status

The study showed that, education level (p=0.001), monthly income (p=0.047), employment status (p=0.009), age at first pregnancy (p=0.002), mode of delivery (p=0.003), and attendance at antenatal care (p=0.031) were significantly associated with anemia status (Table 6).

Predictors of current anemia status among pregnant women attending ANC

Lower education levels and a monthly income between GHS 500-1500 were significantly associated with anemia, with odds ratios of 0.45 (p=0.031) and 0.47 (p=0.048), respectively. Self-employment was also a significant predictor, with an odds ratio of 0.39 (p=0.011), indicating a lower likelihood of anemia compared to unemployment. While employment status showed a trend toward significance (p=0.053), it was not statistically significant. Other variables, such as age at first pregnancy, mode of delivery, and ANC attendance, did not show significant associations (Table 7).

Discussion

Anemia is a significant public health issue, particularly during pregnancy, as it can lead to adverse outcomes for both mothers and their babies. This study assesses the predictors of prevalence of anemia among pregnant women attending antenatal care at a regional hospital in Ghana. Ultimately, the findings aim to inform public health initiatives to reduce anemia and improve maternal and neonatal health outcomes.

Most respondents accurately identify anemia as a reduction in red blood cells or hemoglobin levels. However, there is a minority who mistakenly believe that anemia involves an increase in red blood cells or is caused by a viral infection, and some respondents are uncertain about its nature. People who think anemia is caused by an increase in red blood cells or a viral infection may not seek appropriate medical care, leading to delayed diagnosis and treatment of the underlying cause[22, 23]. Those who are uncertain about the nature of anemia may not take steps to prevent it, such as maintaining a balanced diet rich in iron, vitamin B12, and folate[23].

There is a broad recognition among respondents of the various causes and risks associated with anemia. These include malnutrition, parasitic infections, malaria, blood loss, chronic illnesses, high parity (having many children), and short intervals between pregnancies. The recognition of these risk factors indicates that there is a general awareness of anemia and its contributing factors within the surveyed population[24, 25]. This awareness is crucial for promoting preventive measures, such as improving nutrition, controlling parasitic infections, and ensuring adequate spacing between pregnancies. However, further research would be needed to assess the depth of this knowledge and how it translates into actual prevention and treatment practices[3, 26].

Awareness of anemia symptoms is generally high among respondents. Commonly recognized symptoms include paleness of the skin, shortness of breath, weakness, poor appetite, fainting, and headaches. A significant portion of respondents believe that anemia is treatable, though there remains a smaller segment who think it is not treatable, along with some who are unsure. Many respondents acknowledge pregnancy as a high-risk period for anemia. They are aware of the associated risks to both maternal health and the health of the unborn baby. The awareness of anemia

symptoms among respondents is indeed high, with commonly recognized symptoms including paleness of the skin, shortness of breath, weakness, poor appetite, fainting, and headaches. This suggests that the general public has a good understanding of the signs and symptoms associated with anemia, which is crucial for early detection and treatment[27].

The fact that a significant portion of respondents believe anemia is treatable indicates a positive outlook on the condition. This is supported by the medical literature, which emphasizes the importance of early diagnosis and treatment to reverse anemia[13, 24, 27]. The treatment options for anemia include iron supplements, folic acid supplements, and in severe cases, blood transfusions. These interventions can effectively manage anemia and prevent its complications. However, there is still a smaller segment of respondents who are unsure or believe anemia is not treatable. This may be due to a lack of understanding about the condition or its treatment options[28, 29]. It is essential to educate the public about anemia, its causes, symptoms, and treatment options to alleviate these misconceptions.

The awareness of anemia as a high-risk period for both maternal health and the health of the unborn baby is also significant. This highlights the importance of prenatal care and monitoring for anemia during pregnancy. The medical community emphasizes the need for early detection and treatment of anemia to prevent complications that can affect both the mother and the baby.

Respondents advocate for various preventive measures against anemia. These include consuming an iron-enriched diet, taking iron and folic acid supplements, eating fruits, spacing childbirth, exercising, deworming, and using insecticide-treated nets. However, awareness about the impact of drinking tea, coffee, and milk after meals on iron absorption varies among respondents. These insights reflect a comprehensive understanding of anemia, highlighting areas of both accurate knowledge and common misconceptions. One particularly noteworthy finding is the widespread adoption of iron folic acid supplementation, with a substantial number of respondents incorporating these supplements into their routines. This positive uptake underscores the recognition of folic acid's pivotal role in sustaining healthy red blood cells and staving off anemia[3, 30]. However, the varied frequency of supplementation, spanning from daily to infrequent usage, suggests potential areas for enhancing consistency and adherence to recommended dosages among the populace[12].

Most respondents were regularly deworming, this proactive approach holds merit, given its efficacy in thwarting parasitic infections and associated health complications. Additionally, the conscientious use of insecticide-treated nets (ITNs) by 59.2% of respondents emerges as a commendable preventive measure against mosquito-borne diseases like malaria. These proactive measures (dewormers and use of ITN) demonstrate a praiseworthy commitment to personal health, reducing the risk of parasitic infections and mosquito-borne diseases like malaria[3, 31], This underscores the growing awareness of preventive healthcare measures, emphasizing the importance of education and awareness campaigns to promote such practices and foster healthier communities[12].

A significant portion of respondents (59.2%) are unaware of their anemia status. This lack of awareness suggests a crucial gap in education and communication about anemia's risks and symptoms during pregnancy. Improved awareness programs and educational campaigns are essential to ensure that more women understand the importance of monitoring their anemia status[32]. Encouragingly, 40.8% of respondents are aware of their anemia status, indicating that some women are proactive about their health. This awareness is likely influenced by effective communication from healthcare providers during antenatal visits[33, 34]. These findings underscore the importance of regular ANC visits, which provide crucial opportunities for monitoring hemoglobin levels and implementing timely interventions. The data highlights the need for comprehensive education and awareness programs about anemia during pregnancy, targeting both pregnant women and healthcare providers[32]. Digital health can be leverage to improve awareness on illness during pregnancy including Anemia [35]

At the time of registration, 41.6% of respondents were classified as anemic, with hemoglobin levels below 11g/dl. This high prevalence of anemia at the beginning of pregnancy is alarming, as it can lead to adverse outcomes such as

preterm birth, low birth weight, and increased maternal mortality. The remaining 58.4% had non-anemic hemoglobin levels, which is a positive sign[36]. However, the initial high anemia rates indicate a need for pre-pregnancy nutritional interventions and early screening programs to identify and manage anemia before conception [12]. The prevalence of anemia in pregnancy is a global concern, with significant variations across different regions. According to the World Health Organization (WHO), anemia affects approximately 40% of pregnant women worldwide[37]. This condition is primarily attributed to iron deficiency, exacerbated by increased iron demands during pregnancy [12, 27]. Studies have shown that anemia in pregnancy is associated with increased risks of maternal and neonatal morbidity and mortality. Therefore, addressing this issue requires a multifaceted approach, including dietary interventions, supplementation programs, and improved healthcare access.

During the current ANC visit, 38.8% of respondents were found to be anemic, reflecting a slight improvement from the initial registration figures. This reduction suggests that some women received effective treatment or made lifestyle changes to improve their anemia status. It underscores the importance of continuous monitoring and intervention throughout pregnancy. The remaining 61.2% maintained non-anemic hemoglobin levels, indicating that a significant number of women are successfully managing their anemia during pregnancy. However, the persistence of a 38.8% anemia rate during ANC visits still points to a substantial public health challenge. Regular antenatal care (ANC) visits are critical for early detection and management of anemia[38]. ANC visits provide a platform for healthcare providers to educate pregnant women about the importance of maintaining adequate hemoglobin levels and adhering to prescribed supplements[39]. There is the need to enhanced so that pregnant women go for routine hemoglobin screenings during ANC visits can help identify anemic women early and provide timely treatment interventions[40].

The significant association between lower education levels and anemia, with an odds ratio of 0.45 ($p=0.031$), suggests that individuals with lower levels of education are more likely to experience anemia during pregnancy. Education plays a crucial role in increasing health literacy and knowledge about nutrition, disease prevention, and the importance of seeking medical care[41]. Those with lower educational attainment may have limited access to or understanding of the importance of preventive healthcare measures such as adequate nutrition, proper supplementation, and regular antenatal visits. Public health interventions that focus on improving education, particularly regarding anemia prevention and maternal health, could contribute to reducing anemia prevalence in this group [26].

In relation to above, the finding that individuals with a monthly income between GHS 500 and GHS 1500 are significantly associated with anemia, with an odds ratio of 0.47 ($p=0.048$), implies that lower income levels may limit access to adequate nutrition and healthcare. This income bracket may not allow for the purchase of iron-rich foods or supplements, leading to an increased risk of anemia. Additionally, financial constraints may prevent individuals from accessing quality healthcare, including regular antenatal care and anemia screenings [32]. Interventions that improve income or provide subsidized healthcare and nutritional support for low-income pregnant women could reduce the burden of anemia in this population [42].

Self-employment emerged as a significant predictor of anemia, with an odds ratio of 0.39 ($p=0.011$), indicating a lower likelihood of anemia compared to unemployment. This suggests that self-employed individuals might have more flexibility in managing their health, including better access to healthcare and the ability to prioritize their nutrition. Self-employed individuals may also have more control over their working hours, allowing them time to attend ANC visits or engage in healthier lifestyles[43] (Azhar et al., 2021). This finding may imply that promoting self-employment or offering more flexible working conditions for employed women could contribute to better maternal health outcomes, including lower anemia rates [29]. While employment status showed a trend toward significance ($p=0.053$), it did not reach statistical significance, suggesting that there may be some relationship between being employed and the likelihood of anemia, but the effect was not strong enough to conclude a definitive association. Employment might influence access to healthcare, nutritional status, and overall well-being, but the variability in employment types (e.g., full-time, part-time, informal sector) may explain the lack of a clear

association in this study [27]. Future studies may explore more specific employment categories to better understand their impact on maternal health and anemia prevalence.

A limitation of this cross-sectional study is its inability to establish causal relationships, as the data were collected at a single point in time, making it difficult to infer how socio-demographic factors may influence anemia over time. Additionally, the study's reliance on self-reported data could introduce biases such as recall or social desirability bias. Despite these limitations, the study provides valuable insights into the prevalence of anemia and the associated socio-demographic factors, with a large sample size enhancing the reliability of its findings. Furthermore, the identification of key factors such as education level, income, and employment status offer valuable information for public health initiatives aimed at addressing anemia in pregnant women.

Conclusion and recommendation

In conclusion, the study identifies significant predictors of anemia among pregnant women, including lower education levels, income between GHS 500-1500, and self-employment. These findings suggest the need for targeted interventions to improve education, income, and employment opportunities, as these factors may influence access to healthcare and adherence to anemia prevention measures. The government should prioritize nutrition programs, iron supplementation, and strategies to reduce poverty, while midwives should be at the forefront of educating pregnant women about anemia prevention and closely monitoring hemoglobin levels during antenatal visits. Future research should further investigate the specific causes of anemia in different demographic groups, explore the long-term impacts on maternal and child health, and assess the effectiveness of anemia interventions. Additionally, leveraging telehealth services can improve access to healthcare, especially in rural areas, where pregnant women may face barriers to regular ANC visits. While knowledge about anemia is widespread, the study's findings emphasize that current anemia levels among pregnant women remain alarmingly high, underscoring the need for comprehensive public health strategies, including better education, treatment, and prevention measures, to address this critical issue.

Consent for publication

Not applicable

Data Availability

Data used to support this study are available from the corresponding author upon request.

Disclaimer (Artificial intelligence)

Authors at this moment declare that generative AI (ChatGPT) has been used during the editing of manuscripts.

References

[1] Nguyen TV, King J, Edwards N, et al. "Under great anxiety": Pregnancy experiences of Vietnamese women with physical disabilities seen through an intersectional lens. *Soc Sci Med* 2021; 114231.

[2] Abu Hashim H, Foda O, Ghayaty E. Lactoferrin or ferrous salts for iron deficiency anemia in pregnancy: A meta-analysis of randomized trials. *Eur J Obstet Gynecol Reprod Biol* 2017; 219: 45–52.

[3] Goudet S, Murira Z, Torlesse H, et al. Effectiveness of programme approaches to improve the coverage of maternal nutrition interventions in South Asia. *Matern Child Nutr* 2018; 14: 1–11.

[4] Stevens GA, Finucane MM, De-Regil LM, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe Anemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. *Lancet Glob Heal* 2013; 1: e16–e25.

[5] Yaya S, Anjorin SS, Adedini SA. Disparities in pregnancy-related deaths: spatial and Bayesian network analyses of maternal mortality ratio in 54 African countries. *BMJ Glob Heal* 2021; 6: e004233.

[6] Anand IS, Gupta P. Anemia and iron deficiency in heart failure: current concepts and emerging therapies. *Circulation* 2018; 138: 80–98.

[7] Chathuranga G, Balasuriya T, Perera R. Anemia among female undergraduates residing in the hostels of University of Sri Jayewardenepura, Sri Lanka. *Anemia*; 2014.

[8] Kassebaum NJ, Jasrasaria R, Naghavi M, et al. A systematic analysis of global anemia burden from 1990 to 2010. *Blood* 2014; 123: 615–624.

[9] Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health Review on iron and its importance for human health. 2015; 19: 1–9.

[10] Gaillard R, Eilers PHC, Yassine S, et al. Risk Factors and Consequences of Maternal Anemia and Elevated Haemoglobin Levels during Pregnancy : a Population-Based Prospective Cohort Study. 2014; 213–226.

[11] Anlaakuu P, Anto F. Anemia in pregnancy and associated factors: a cross sectional study of antenatal attendants at the Sunyani Municipal Hospital, Ghana. *BMC research notes*; 10. Epub ahead of print 2017. DOI: 10.1186/s13104-017-2742-2.

[12] Lebso M, Anato A, Loha E. Prevalence of anemia and associated factors among pregnant women in Southern Ethiopia: A community based cross-sectional study. *PLoS One* 2017; 12: 1–11.

[13] Appiah PK, Nkuah D, Bonchel DA. Knowledge of and adherence to Anemia prevention strategies among pregnant women attending antenatal care facilities in Juaboso district in Western-north region, Ghana. *J Pregnancy*; 2020.

[14] GSS, GHS, ICF. *Ghana Demographic and Health Survey 2014*. Accra, 2015.

[15] Helegbe GK, Aryee PA, Mohammed BS, et al. Seroprevalence of malaria and hepatitis B coinfection among pregnant women in tamale metropolis of Ghana: a cross-sectional study. *Can J Infect Dis Med Microbiol*; 2018.

[16] Anemias WHON. Tools for Effective Prevention and Control. *World Heal Organ Geneva, Switz*.

[17] Wemakor A. Prevalence and determinants of Anemia in pregnant women receiving antenatal care at a tertiary referral hospital in Northern Ghana. *BMC Pregnancy Childbirth* 2019; 19: 1–11.

[18] Adjei-Gyamfi S, Zakaria MS, Asirifi A, et al. Maternal Anemia and polycythaemia during pregnancy and risk of inappropriate birth weight for gestational age babies: a retrospective cohort study in the northern belt of Ghana. *BMJ Open* 2024; 14: e082298.

[19] Setia MS. Methodology series module 3: Cross-sectional studies. *Indian J Dermatol* 2016; 61: 261.

[20] Polit DF, Beck CT. *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins, 2008.

[21] Patience D. Knowledge and perception of risk of Anemia during pregnancy among pregnant women in Ablekuma South.

[22] Turner J, Parsi M, Badireddy M. Anemia. In: *StatPearls [Internet]*. StatPearls Publishing, 2022.

[23] Chaparro CM, Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low-and middle-income countries. *Ann N Y Acad Sci* 2019; 1450: 15–31.

[24] Sangwan KS, Kshirsagar VD, Parande MA, et al. Knowledge, attitude and practices regarding nutrition among pregnant females visiting the antenatal care outpatient department of a tertiary care hospital, Pune. *Int J Community Med Public Heal* 2022; 9: 902.

[25] Gebreegziabher T, Sidibe S. Prevalence and contributing factors of Anemia among children aged 6–24 months and 25–59 months in Mali. *J Nutr Sci* 2023; 12: e112.

[26] Alem AZ, Efendi F, McKenna L, et al. Prevalence and factors associated with anemia in women of reproductive age across low-and middle-income countries based on national data. *Sci Rep* 2023; 13: 20335.

[27] Lopez de Romaña D, Mildon A, Golan J, et al. Review of intervention products for use in the prevention and control of anemia. *Ann N Y Acad Sci* 2023; 1529: 42–60.

[28] Bizuneh AD, Azeze GG. Knowledge on Anemia and benefit of iron–folic acid supplementation among pregnant mothers attending antenatal care in Woldia town, Northeastern Ethiopia: a facility-based cross-sectional study. *J Heal Popul Nutr* 2022; 41: 32.

[29] Weckmann G, Kiel S, Chenot J-F, et al. Association of anemia with clinical symptoms commonly attributed to anemia—analysis of two population-based cohorts. *J Clin Med* 2023; 12: 921.

[30] Kateera F, Ingabire CM, Hakizimana E, et al. Malaria, Anemia and under-nutrition: three frequently co-existing conditions among preschool children in rural Rwanda. *Malar J* 2015; 14: 1–11.

[31] Obol JH, Ononge S, Orach CG. Utilisation of insecticide treated nets among pregnant women in Gulu: A post conflict district in northern Uganda. *Afr Health Sci* 2013; 13: 962–969.

[32] Gillespie B, Katageri G, Salam S, et al. Attention for and awareness of anemia in adolescents in Karnataka, India: a qualitative study. *PLoS One* 2023; 18: e0283631.

[33] Balaji K, Priya VV, Gayathri R. Knowledge And Awareness on Iron Deficiency Anemia Among Women-A Questionnaire Based Survey. *JETT* 2022; 13: 80–93.

[34] Syarif AL, Ansariadi A, Wahiduddin W, et al. Awareness and practices in preventing maternal iron deficiency among pregnant women living in urban slum areas in Makassar City, Indonesia. *J Educ Health Promot* 2023; 12: 452.

[35] Asumah MN, Mohammed MY, Abubakari A, et al. Improving maternal health services utilization in Ghana: should digital health be considered? Correspondence. *Ann Med Surg* 2023; 85: 557.

[36] Furlong E, Carter T. Aplastic Anemia: Current concepts in diagnosis and management. *J Paediatr Child Health* 2020; 56: 1023–1028.

[37] WHO. Global Nutrition Targets 2025 : Anemia Policy Brief (WHO/NMH/NHD/14.4). *Glob Nutr Targets 2025* 2014; 2: 8.

[38] Worku Takele W, Tariku A, Wagnew Shiferaw F, et al. Anemia among women attending antenatal care at the University of Gondar comprehensive specialized referral hospital, Northwest Ethiopia, 2017. *Anemia*; 2018.

[39] Neogi SB, Babre A, Varghese M, et al. Improving the approach to assess impact of Anemia control programs during pregnancy in India: a critical analysis. *BMC Pregnancy Childbirth* 2022; 22: 966.

[40] Nachinab GT, Yakong VN, Dubik JD, et al. Perceptions on birth preparedness and complication readiness: perspectives of pregnant women. *Sage Open* 2023; 13: 21582440231207136.

[41] Engidaw MT, Lee P, Fekadu G, et al. Effect of Nutrition Education During Pregnancy on Iron–Folic Acid Supplementation Compliance and Anemia in Low-and Middle-Income Countries: A Systematic Review and Meta-analysis. *Nutr Rev* 2024; nuae170.

[42] Ngimbudzi EB, Massawe SN, Sunguya BF. The burden of anemia in pregnancy among women attending

the antenatal clinics in Mkuranga District, Tanzania. *Front Public Heal* 2021; 9: 724562.

[43] Azhar BS, Islam MS, Karim MR. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: a cross-sectional study. *Prim Health Care Res Dev* 2021; 22: e61.

Table 1: Socio-demographic characteristics

Variables	***Categories***	***Frequency***	***Percent***
Age			
	< 20 years	48	19.2
	20 - 29 years	109	43.6
	30- 39 years	69	27.6
	≥ 40 years	24	9.6
Marital status			
	Single	39	15.6
	Married	211	84.4
Highest level of education			
	None	103	41.2
	Basic education	88	35.2
	Senior High School	40	16
	Tertiary	19	7.6
Religion			
	Islam	131	52.4
	Christianity	98	39.2
	Traditionalist	21	8.4
Monthly income (GHS)			
	< GHS 500	156	62.4
	GHS 500-1500	48	19.2
	GH¢1500 - GH¢2500	23	9.2
	Above GH¢2500	23	9.2
Number in household			
	< 4	183	73.2
	≥ 4	67	26.8
Spouse/partner's educational status			
	None	97	38.8

	Basic education	74	29.6
	Senior High School	45	18
	Tertiary	34	13.6
Respondent's employment status			
	Employed	25	10
	Self-employed	61	24.4
	Unemployed	164	65.6

Table 2: Obstetric characteristics

Variables	***Categories***	***Frequency***	***Percent***
Age at first pregnancy			
	<20 years	47	18.8
	20-24 years	112	44.8
	25-29 years	73	29.2
	≥ 30 years	18	7.2
Gravidity			
	< 4	146	58.4
	≥ 4	104	41.6
Parity (number of live babies)			
	< 3	121	48.4
	≥ 3	129	51.6
Gestational age in the trimester			
	First trimester	83	33.2
	Second trimester	109	43.6
	Third trimester	58	23.2
Place of delivery in your delivery			
	Home	29	11.6
	Hospital	221	88.4
Mode of delivery in recent birth			
	SVD	211	84.4
	CS	39	15.6
Indication for CS (n=39)			
	Post date	13	33.3
	Big baby	7	17.9
	Prolonged second stage	4	10.3
	Abruptio	9	23.1
	Placenta previa	6	15.4
Did you attend ANC in your recent delivery?			

Yes	231	92.4
No	19	7.6

Table 3: Knowledge of anemia among pregnant women

Variables	***Categories***	***Frequency***	***Percent***
Anemia meaning			
	A decrease in the concentration of red blood cells or Hb level in the blood	199	79.6
	An increase in the concentration of red blood cells	18	7.2
	A viral infection in the blood cells	11	4.4
	Not sure	22	8.8
Causes/risk of anemia			
	Malnutrition	214	85.6
	Parasitic infection	167	66.8
	Malaria	189	75.6
	Acute/chronic blood loss	206	82.4
	Chronic medical illness	105	42
	High parity	59	23.6
	Short inter-pregnancy interval	71	28.4
Signs/symptoms showing anemia			
	Paleness of the skin	243	97.2
	Shortness of breathing	194	77.6
	Physical weakness/fatigue	201	80.4
	Poor appetite	177	70.8
	Fainting	109	43.6
	Headache	135	54
Can anemia be treated?			
	Yes	195	78
	No	37	14.8
	Don't know	18	7.2
Pregnancy is a high risk for anemia			
	Yes	208	83.2
	No	42	16.8
Can anemia cause a serious problem in maternal health?			

Yes	217	86.8
No	33	13.2
anemia can serious problem for unborn baby		
Yes	184	73.6
No	66	26.4
Ways to prevent anemia		
Eating iron-enriched diet	215	86
Taking IFAS	189	75.6
Fruits	207	82.8
Spacing the children	101	40.4
Exercising	74	29.6
Deworming	127	50.8
Sleeping under ITNs	148	59.2
Drinking tea, coffee, and milk after meals reduces iron absorption in the body		
Yes	102	40.8
No	58	23.2
Not sure	90	36

Table 5: Prevalence of anemia among pregnant women

Variables	***Categories***	***Frequency***	***Percent***
Do you know your anemia status?			
	Yes	102	40.8
	No	148	59.2
Hemoglobin level at registration			
	Anaemic (<11g/dl)	104	41.6
	Non-Anemia (≥ 11g/dl)	146	58.4
Hemoglobin level at current ANC visit			
	Anaemic (<11g/dl)	97	38.8
	Non-Anemia (≥ 11g/dl)	153	61.2

Table 6: Association between socio-demographics characteristics and current Anemia status

Variable	*Categories*	*Anaemic (<11g/dl) n=97*	*Non-Anemic (≥11g/dl) n=153*	*Chi-Square (p-value)*
Age				0.345
	< 20 years	19 (7.5%)	29 (11.3%)	
	20 - 29 years	38 (15.2%)	71 (28.0%)	
	30 - 39 years	25 (10.0%)	44 (17.6%)	
	≥ 40 years	15 (6.0%)	9 (3.6%)	
Marital Status				0.673
	Single	15 (6%)	24 (9.6%)	
	Married	82 (32.8%)	131 (52.4%)	
Highest Level of Education				0.001
	None	40 (16%)	63 (25.2%)	
	Basic education	31 (12.4%)	57 (22.8%)	
	Senior High School	16 (6.4%)	24 (9.6%)	
	Tertiary	7 (2.8%)	12 (4.8%)	
Religion				0.145
	Islam	52 (20.8%)	79 (31.6%)	
	Christianity	38 (15.2%)	60 (24%)	
	Traditionalist	7 (2.8%)	14 (5.6%)	
Monthly Income (GHS)				
	< GHS 500	61 (24.4%)	95 (38%)	0.047
	GHS 500 - 1500	19 (7.6%)	29 (11.6%)	
	GHS 1500 - 2500	9 (3.6%)	14 (5.6%)	
	Above GHS 2500	8 (3.2%)	15 (6%)	
Number in Household				
	< 4	61 (24.4%)	95 (38%)	0.389
	≥ 4	36 (14.4%)	58 (23.2%)	
Spouse's Education Status				
	None	36 (14.4%)	61 (24.4%)	0.347
	Basic education	26 (10.4%)	48 (19.2%)	
	Senior High School	16 (6.4%)	29 (11.6%)	
	Tertiary	9 (3.6%)	15 (6%)	
Employment Status				
	Employed	3 (1.2%)	22 (8.8%)	0.009
	Self-employed	9 (3.6%)	52 (20.8%)	
	Unemployed	85 (34%)	79 (31.6%)	
Age at First Pregnancy				

	<20 years	17 (6.8%)	30 (12%)	0.002
	20-24 years	48 (19.2%)	64 (25.6%)	
	25-29 years	23 (9.2%)	50 (20%)	
	≥ 30 years	9 (3.6%)	9 (3.6%)	
Gravidity				
	< 4	41 (16.4%)	62 (24.8%)	0.217
	≥ 4	56 (22.4%)	79 (31.6%)	
Gestational Age (Trimester)				
	First trimester	32 (12.8%)	51 (20.4%)	0.389
	Second trimester	43 (17.2%)	66 (26.4%)	
	Third trimester	22 (8.8%)	36 (14.4%)	
Place of Delivery				
	Home	11 (4.4%)	18 (7.2%)	0.212
	Hospital	86 (34.4%)	140 (56%)	
Mode of Delivery				
	SVD	77 (30.8%)	134 (53.6%)	0.003
	CS	20 (8%)	19 (7.6%)	
Did you attend ANC in recent delivery?				
	Yes	85 (34%)	146 (58.4%)	0.031
	No	12 (4.8%)	7 (2.8%)	

Table 7 Predictor of current Anemia status among pregnant women attending ANC

Variables	**Category**	**Odds Ratio (OR) (95% CI)**	**p-value**
Highest level of education	None	Ref	
	Basic education	**0.45 (0.22 - 0.93)**	**0.031**
	Senior High School	**0.60 (0.28 - 1.26)**	0.185
	Tertiary (ref: None)	0.82 (0.33 - 2.06)	0.67
Monthly income (GHS)	< GHS 500	Ref	
	GHS 500 - 1500	**0.47 (0.22 - 0.99)**	**0.048**
	GHS 1500 - 2500	**0.72 (0.24 - 2.13)**	0.556
	Above GHS 2500	**0.65 (0.22 - 1.94)**	0.438
Employment status	Unemployed	Ref	
	Employed	**0.34 (0.11 - 1.02)**	**0.053**
	Self-employed	**0.39 (0.19 - 0.80)**	**0.011**
Age at first pregnancy	<20 years	Ref	
	20-24 years	1.15 (0.66 - 2.00)	0.621
	25-29 years	1.34 (0.71 - 2.54)	0.368
	≥ 30 years	0.71 (0.22 - 2.22)	0.555
Mode of delivery	SVD	Ref	
	CS	1.63 (0.76 - 3.50)	0.207
Did you attend ANC in recent delivery?	No	Ref	
	Yes	2.10 (0.85 - 5.19)	0.105