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Original Article

DETERMINANTS OF ANAEMIA IN PREGNANCY AT THE ANTENATAL CLINIC OF A MUNICIPAL HOSPITAL, GHANA

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ABSTRACT

Background: Anaemia, defined by low blood haemoglobin concentration, is a major public health problem, especially in developing countries. Pregnant women are most vulnerable to anaemia due to factors including parasitic infection and feeding habits leading to increased maternal morbidity and mortality, as well as adverse effects on foetal health.

Aim: The study aims to assess the prevalence of anaemia and identify associated factors among pregnant women receiving antenatal care at the Ho Municipal Hospital.

Methods: This was a cross-sectional study conducted among 360 pregnant women from February to March, 2021. Data on factors and haemoglobin levels at current pregnancy were collected using a structured questionnaire. Data were analyzed using EXCEL and STATA 14 software employing bivariate and multivariate regression analyses to determine odd ratios at a 95% confidence level.

Results: Of the 360 women interviewed, 296 (82.2%) were anaemic with haemoglobin levels below 11 g/dl and a mean concentration of 9.72 g/dl. Among the anaemic women, 178(49.44%) had mild anaemia, 114(31.67%) were moderately anaemic, and 4 (1.12%) were severely anaemic. Maternal age (OR: 3.0, 95% CI: 1.55-5.8, $p<0.001$) and pregnancy trimester (OR: 11.59, 95% CI: 5.0-26.5, $p<0.001$) were significant predictors of anaemia in pregnancy.

Conclusions: The prevalence of anaemia among antenatal care attendees at Ho Municipal Hospital was high compared to the WHO classifications. Efforts should be directed to educating women about iron supplementation, the impact of maternal age, and the prevention and treatment of malaria during pregnancy. Dietary advice should be incorporated with ANC services. Making iron supplements more accessible and affordable for women of reproductive age who are unable to plan for pregnancies is also essential.

Keywords: Anaemia, Pregnancy, Prevalence, Determinants, Antenatal Care

INTRODUCTION

Pregnancy is not just a matter of waiting to give birth but a joyful and fulfilling period in a woman's life (Anlaakuu, 2015). It can also be one of the experiences of misery and suffering when complications or adverse circumstances compromise the pregnancy, which might cause ill health or even death to either the mother or the foetus (Patil, 2013). Pregnancy is also said to be one of the most unique periods of a woman's life-cycle (Chowdhury et al., 2015). Anaemia hence refers to a condition in which the haemoglobin content in the human blood is lower than normal for a person´s age, gender and environment, resulting in the oxygen-carrying capacity of the blood being reduced (Omote et al., 2020). The most reliable indicator of anaemia at the population level is haemoglobin concentration although it does not indicate the cause Haemoglobin is an iron-containing oxygen transport protein in red blood cells of all vertebrates. It is composed of a protein group known as globin and four hem groups. Its function is to carry oxygen from the lungs to other parts of the body. It is produced by the bone marrow and destroyed by the spleen. Anaemia can present in two forms symptomatic or asymptomatic. Dizziness, palpitation,

easy fatigability are some of the symptoms a person can exhibit when suffering from anaemia. Anaemia is therefore classified as a major public health problem throughout the world, particularly for women of reproductive age in developing countries. According to the Centre for Disease Control (CDC), anaemia is defined as pregnancy haemoglobin level less than 11 g/dl in the first and third trimester and less than 10.5 g/dl in the second trimester (WHO, 2012). Also, World Health Organization (WHO), defines anaemia in pregnancy as pregnant women with haemoglobin levels less than 11.0 g/dl in all trimesters (Stephen et al., 2018).

Furthermore, pregnant women are particularly considered to be the most vulnerable group to anaemia, because of the additional demands made during pregnancy. Research has also proven that anaemia resulting from iron deficiency adversely affects cognitive and motor development, causes fatigue and low productivity and when it occurs in pregnancy, may be associated with low birth weight and increased risk of maternal and perinatal mortality(Tandon et al., 2018). Nevertheless, numerous studies conducted in developing countries show that anaemia, especially iron-deficiency anaemia (IDA), is highly prevalent among pregnant women(Pobee et al., 2021). According to the World Health Organization, anaemia in pregnancy (also known as gestational anaemia) affects about 1.62 billion people worldwide, of which 56 million are pregnant women (Webbo et al., 2020). Some studies conducted in Africa show significant variations in the prevalence of anaemia between countries (Teshale et al., 2020). Ghana has been included among the countries in Africa with a high prevalence of anaemia in pregnancy. As evidence suggests that most women in low-income countries, including Ghana, enter pregnancy with less than adequate stores of nutrients, this could have serious adverse pregnancy outcomes, such as premature delivery and perinatal mortality (Tibambuya et al., 2019). More so, anaemia has been identified as the second cause of all admissions and the fifth cause of death among all admitted patients in Ghana(Kofie et al., 2019). The Volta Region has been identified as the region with the highest prevalence of about 49% of anaemia among women in their reproductive age in the country (Kofie et al., 2019).

METHODS

Study Design

A hospital-based cross-sectional study was carried out at the Ho municipal hospital in the Volta Region from February to March 2022. Routine antenatal services provided include Intermittent Preventive Treatment for malaria in Pregnancy (IPTp), health education, immunization, and monitoring of haemoglobin levels of the women. Primary data were collected from the women as well as a review of their antenatal records.

Data Collection Technique and Tools

The study employed two main approaches for data collection. These were data extraction from participants' ANC Booklet and administration of a structured questionnaire. Data were collected from the pregnant women after they had given written informed consent and received ANC services for the day. Relevant data were extracted from the ANC booklet of the pregnant women and recorded. A structured questionnaire was used to collect data on the age of participants, occupation of pregnant woman, level of education, marital status, 'pica' (clay) consumption, frequency of consumption of iron-containing foods, and bed net usage. The data was initially coded and then entered in Microsoft Excel and after initial data cleaning the data was analysed using STATA version 14.0. Continuous variables were expressed in mean and standard deviation while categorical variables were summarized as percentages. Fisher's exact test was used to assay for the association between study variables. P-values of ≤ 0.05 were considered significant

Study Population

The research population for the study was aimed at pregnant women between the ages of 18-39years attending the antenatal clinic at the Ho Municipal Hospital at the time of the study

Sampling

The antenatal clinic had three different consulting rooms. Fifteen participants were randomly selected on each day with five from each consulting room using a sampling interval of two. The first participants for each day were automatically the first client who reported to the consulting rooms after which two clients were skipped then the next surveyed till a total of fifteen participants were enrolled at the end of each day. Participants who did not consent to participate in the study were replaced with the next person following her. This was repeated until the required sample was obtained after twenty-four days (2nd February to 5th March 2021). The sample size was

estimated using the prevalence of anaemia in pregnancy reported for the Hohoe Municipality (33%) (Kofie et al., 2019). Using the Cochran formula, $n = (Z^2pq)/e^2$ (Wilson, 2016), where: n = sample size, Z = the z-score that corresponds with 95% confidence interval (1.96), P = proportion of anaemia in pregnancy (33%, =0.33), q = proportion of antenatal attendants who are not anaemic (1–0.33%, =0.67), e = margin of error set at 5% (0.05), a sample size of n = 340 was estimated. To account for a non-response rate of 6%, 20 additional participants were added, resulting in a total sample size of 360.

Pre-testing

The questionnaires were tested at the Ho Policlinic from 13th of January to 20th of January, to identify any potential issues with the questions. Following the pre- testing exercise, necessary corrections were made including the removal of certain questions to streamline the process and save time. Research assistants were recruited and trained for the purpose of data collection, with a focus on effective communication skills and accurate data collection methods. At the end of each day during the data collection phase, data were assessed to ensure completeness and accuracy. Double data entry was done afterwards and any discrepancies between entries were resolved by cross-referencing the original questionnaires to minimize errors.

Data Handling and Analysis

Data from each section were kept in labelled envelopes and securely locked. Field data was checked for consistency and completeness, and accuracy. Consistency checks were done; cleaning of errors was effected. Data entry started almost immediately after collection and proceeded concurrently. Final datasets were stored on a password-protected computer, with consent forms stored securely under lock and key in separate storage. No imputations were made for missing data. Data was entered into Excel cleaned and exported to STATA. Data analysis was done with the STATA statistical software package (StataCorp.2007. Stata Statistical Software. Release *14. StataCorp LP, College Station, TX, USA*). Categorical variables were summarized into frequencies and proportions. Continuous variables were summarized into means and ranges. Continuous variables such as age were re-categorized into Age groups, Hb at the first visit was re-categorised into Mild Anaemia (Hb 10 – 10.9g/dl), Moderate Anaemia (7 – 9.9g/dl) and Severe Anaemia (Hb< 7g/dl) (WHO, 2001). Hb at the current visit was categorized into anaemia (Hb<11.0g/dl) and no anaemia (Hb>11.0g/dl) (WHO, 2001) and anaemia at the current visit was used as the main outcome variable. Bivariate analysis was done using Fisher's exact test to assess significant differences between anaemia and categorical variables. Binary logistic regression was used to assess for factors associated with anaemia. Factors with *p-value* <0.05 at 95% CI were considered statistically significant and therefore included in the multiple logistic regression model.

Ethical consideration

Ethical approval for the study was obtained from the Institutional Review Board, Ensign College of Public Health. Informed written consent was obtained from each participant after explaining the purpose of the study, the potential benefits, and the expected outcome. All participants were assured that personal information would be confidential and used only for research purposes. Data collection was done with strict adherence to privacy and confidentiality. Interviews were conducted in private, conducive areas away from the main areas where care was provided. The participants' identifying information was not recorded. Prior to each interview, the participants were assured that they were free to withdraw from the study at any instance in time. Data was only accessible to the principal investigator, research assistants, and the supervisor of the study.

Limitations of the Study.

This study was conducted at a single tertiary care hospital in Ho; and therefore, limits the generalization of the findings to the wider region. Most participants were from urban areas, disregarding the fact that a considerable number of pregnant women in the rural areas had limited access to antenatal facilities. This may well bias the findings with regards to the true prevalence of anaemia, therefore introducing potential sampling bias. To streamline data collection and reduce respondent burden, some variables were not included, hence making the process rather efficient. This approach, however, entails that by evading some relevant information, it may further lead to the loss of data that would add weight to the analysis of the causes and prevalence of anaemia. Despite limitations, valuable insight has been gained in the study into anaemia in pregnancy among urban residents, though general wider interpretations need to be done with care.

RESULTS

Socio-Demographic Characteristics of Respondents

As shown in table 1 below, a total of 360 pregnant women aged 18 – 39years, with a mean age of 28 (± 6years) who accessed Antenatal Care services at the Ho Municipal Hospital took part in the study. Majority of the respondent 151(41.94%) were in the 18-26years age group. About, 191(53.06%) of respondents had Senior High/Vocational level education, 95(26.39%) had at least a primary education, 41(11.39%) had tertiary education, 15(4.17%) had junior high (basic) education, and 18(5%) of women had no formal education. By marital status, 250(69.44%) participants were married, 107(29.72%) single and 3(0.83%) were once married but had separated at the time of the interview. A total of 347(96.39%) of the women were Christians and the remaining 13(3.6%) were Moslems.

Table 1: Socio-Demographic Characteristics of Respondents

Variable	n(%)
Age group	
18-26years	151(41.9)
27-33years	144(40.00)
24-39years	65(18.06)
Educational Level	
No formal education	18(5.00)
Primary Education	95(26.39)
Middle/Junior High School	15(4.17)
Senior High/Vocational School	191(53.06)
Tertiary Education	41(11.39)
Marital Status	
Single	107(29.72)
Married	250(69.44)
Separated	3(0.83)
Religion	
Christian	347(96.39)
Islam	13(3.61)
Occupation	
Education (Teacher/Lecturer)	20(5.56)
Healthcare worker (nurse, doctor,)	10(2.78)
Office work (Civil servant)	9(2.50)
Service worker (hair dresser, seamstress)	97(26.94)
Trader/Vender	152(42.22)
Agricultural Worker (Farmer)	16(4.44)
House wife	6(1.67)
N/A	50(13.89)
Parity	
One Child or none	225(62.50)
Two Children or more	135(37.50)

Obstetric Characteristics of Respondents

Under the obstetric features, the number of live births, the trimesters at which the participant took part in the study and the first ANC visits were the only factors considered. According to the table below, 225(62.50) of women were carrying their first or second pregnancies, and 135(37.50%) were mothers carrying their third or more pregnancies at the time of the study. About half, 182(50.56%) of the women were currently in their second trimester

of pregnancy, 142(39.44%) were in their third trimester and 36(10.00%) were in their first trimester of pregnancy. According to the participants' ANC booklets, the majority 273(75.83%) had their first ANC visit during their first trimester, 73(20.28%) first visited the Antenatal clinic in their second trimester and a minimum of 14(3.89%) of women had their first ANC visits while they were in their third trimester.

Table 1: Obstetric characteristics of respondents

Variables	n(%)
Parity	
Zero-One live birth	225(62.50)
Two life births or more	135(37.50)
Pregnancy Trimester at the time of study	
First Trimester	36(10.00)
Second Trimester	182(80.56)
Third Trimester	142(39.44)
First ANC Visit	
First Trimester	273(75.83)
Second Trimester	73(20.28)
Third Trimester	14(3.89)

Prevalence of anaemia among antenatal attendants

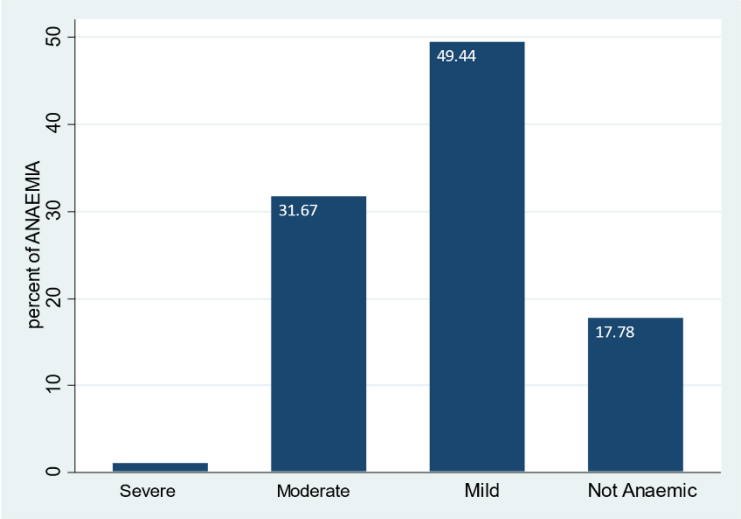

Figure 1: Severity of Anaemia among Respondents

The overall indication of anaemia among respondents was 82%, with a mean HB of 9.72 (± 144) g/dl. With reference to the severity of anaemia among respondents, as shown in the figure 1 below, four women (1.12%) were severely anaemic Hb <7.0g/dl, with mild anaemia being the highest 178 (49.44%) Hb>10.0<11.0 form of anaemia, moderate anaemia 114(31.67) and 64(17.78%) had their Hb>11.0g/dl, the rate at which the women developed anaemia, noted to have increased as the pregnancy develops. It reaches its peak in the second trimester and begins to decline in the third trimester.

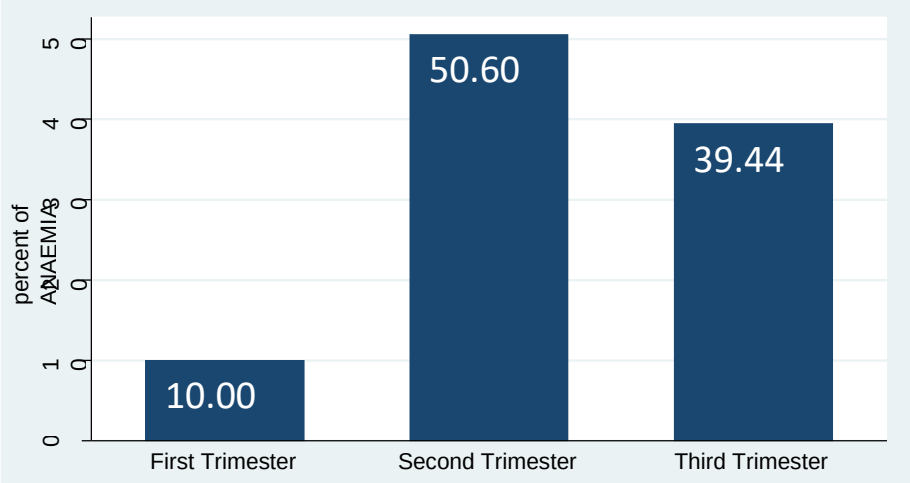

Figure 2: A Bar chart showing the anaemia Pattern with respect to the pregnancy Trimesters

Medical interventions and malaria infections during pregnancy

Twenty-three participants (6.39%) have been infected with malaria during the current pregnancy so far, more than half 310(86.11%) at the time of the interview had not been infected with malaria during the pregnancy period while about 27 individuals couldn't remember if they had ever been infected with malaria or not. Two hundred and twenty-nine (63.61%) of the pregnant women did not sleep under a bed net the previous night before data collection interview while 131(36.39%) did sleep under a treated net the previous night.

Table 2: Medical interventions and malaria infections during pregnancy

Variables	n (%)
Malaria infection during pregnancy	
Yes	23(6.39)
No	310(86.11)
Can't remember	27(7.60)
Gestational Age at which infection occurred	
	6(26.09)
First Trimester	4(17.39)
Second Trimester	13(56.52)
Third Trimester	
Use of bed net the previous night	
Yes	131(36.39)
No	229(63.61)
Malaria Prophylaxis	
Taken	86(23.09)
Not taken	274(76.17)

Bivariate analysis of anaemia status among pregnant women

The table below presents a bivariate analysis of anaemia status among respondents. There was significant difference between the age groups of the women in terms of being anaemic (*p= 0.002*). A hundred and fourteen of the women (38.51%) were between the ages 18 – 26 years, followed by 130(43.92.1%) which fall between the ages 27 – 33 years and 52(17.57%) were between 34 – 39 years. There was also a significant difference in

educational level of women and anaemia (*p=0.045).* Furthermore, the gestational age at which women were interviewed had a significant difference in relation to anaemia p*<0.001)*
Most of the women 182(50.56%) who were anaemic were in their second trimester, 142(39.44%) were in their third trimester and 36(10.00%) were in their first trimester at the time of the interview. There were likewise significant differences among women's occupation (*p=0.035*) and their Marital status (*p=0.007*).

Table 3: Bivariate analysis of anaemia status among pregnant women

Factors	Anaemia		P-Value
	Anaemic n (%)	Not Anaemic n (%)	
Age group			
18-26	114(38.5)	37(57.81)	
27-33	130(43.92)	14(21.88)	0.002
34-39	52(17.57)	13(20.31)	
Educational Level			
No Formal Education	17(5.74)	1(1.56)	
Primary	72(24.32)	23(35.94)	
Middle/JHS	15(5.07)	0(0.00)	0.045
Vocational/SHS	161(54.39)	30(46.88)	
Tertiary	31(10.47)	10(15.63)	
Occupation			
N/A	39(13.18)	11(17.19)	
Education	17(5.74)	3(4.69)	
Healthcare	5(1.69)	5(7.81)	
Office work	5(1.69)	4(6.25)	
Service work	84(28.38)	13(20.31)	0.035
Trader	129(43.39)	23(35.94)	
Agriculture	13(4.39)	3(4.69)	
Housewife	4(1.35)	2(3.13)	
Marital Status			
Single	91(30.74)	16(25.00)	
Married	205(69.26)	45(70.31)	0.007
Separated	0(0.00)	3(4.69)	
Trimester of Pregnancy			
Frist trimester	17(5.74)	19(29.69)	
Second trimester	166(56.08)	16(25.00)	<0.001
Third trimester	113(38.18)	29(45.31)	
Parity			
Zero-One live birth	185(82.22)	40(62 50)	<0.001
Two or more live births	111(17.78)	24(37.50)	

Table 4: Consumption of Iron-containing Foods

Food groups	n (%), (n=360)
Grains, white roots and tubers, and plantain	
Yes	360(100.0)
No	0(0.00)
Pulses (beans, peas and lentils)	
Yes	90(25.00)
No	270(75.00)
Nuts and seeds	
Yes	349(96.94)
No	11(3.06)
Meat, poultry and fish	
Yes	330(91.67)
No	30(8.33)
Dark green leafy vegetables	
Yes	146(40.56)
No	214(59.55)

Binary logistics analysis of factors associated with anaemia among pregnant women

Findings from the bivariate logistic regression model of factors associated with anaemia show that; Age was significantly associated with anaemia. Therefore, pregnant women between 27 – 33 years were three times more likely to become anaemic as compared to their counterparts aged 18 – 26 years, adjusting for all other variables OR 3.0 P =0.001. Gestational age at the interview was also significantly associated with anaemia, therefore a pregnant woman is 1.5 times more likely to develop anaemia at any time within the three trimesters. Nevertheless, the odds of a pregnant woman in their second trimester at the time of interview becoming anaemic is 11.6 times more likely as compared to her counterpart women in their first trimester (*p<0.001*) while for women in their third trimester, are 4.6 times more likely to be anaemic comparing them to those in their first trimester.

Table 5: Multivariate logistics analysis of factors associated with anaemia among pregnant women

FACTORS	Unadjusted p-value	COR (95% CI)	Adjusted p-value	AOR (95% CI)
Age group				
18-27	**Reference**	1	**Reference**	1
27-33yrs	<0.001	3.01(1.55-5.8)	<0.001	3.87(1.88-7.96)
34-39yrs	0.47	1.29(0.63-2.63)	0.48	1.35(0.59-3.10)
Pregnancy trimester at interview				
First	Reference	1	Reference	1
Second	<0.001	11.59(5.0-26.3)	<0.001	14.58(6.01-35.34)
Third	<0.001	4.35(2.0-9.4)	<0.001	4.42(1.9-10.28)

DISCUSSION

Anaemia in pregnancy is one of the most prevalent public health problems especially in developing countries. Anaemia again, poses an increase in overall risk of maternal death. On the foetus, complications include prematurity, low birth weight, low APGAR scores and cognitive impairment. Hence in order to effectively prevent anaemia during pregnancy, it's imperative to identify it contributing factors. The present study has shown that anaemia, is prevalent in the second trimester of pregnancy among women receiving antenatal care at the Ho Municipal Hospital in the Volta region of Ghana. The prevalence of anaemia in this study was found to be 82% which should call for an alarm. But in as much as the prevalence is high majority of the women are with mild or moderate anaemia which often tend to be asymptomatic.

The study also found that, pregnancy trimester at time of interview and age of respondents were the only significant factor that were associated with anaemia in pregnancy after running a multivariate logistic regression. This means that a lot more factors should be considered in other to identify the main cause of rise in anaemia among pregnant women. About 82% of respondents were anaemic at the time of study. This is about 50% higher than what was recorded at the Hohoe Municipal Hospital two years ago, a municipal hospital with the same or similar characteristics as the Ho Municipal Hospital. In as much as the prevalence of anaemia in this study raises an eyebrow, the World Health Organization (WHO) estimates the prevalence of anaemia among pregnant women to vary between 53.8% and 90.2% in developing countries, while in developed countries it is estimated to be 8.3%(Al-Farsi et al., 2012). The majority of the women in this study had mild anaemia to moderate with 1% being severely anaemic. Additional findings also identified that the prevalence of anaemia reduced significantly with increasing age of the woman. As it is observed, most of these women were already anaemic before being pregnant as a result of failure to prepare adequately for the pregnancy. These findings agree with findings from other parts of Nigeria (Mockenhaupt et al., 2015) and Ethiopia (Specialized, 2014) where younger women were prone to developing anaemia during pregnancy than the older once. Also, a study conducted by Al-Farsi *et al* (Al-Farsi *et al.*, 2011) and Uche-Nwachi, E. O.Odekunle.A *et al* (Uche-Nwachi *et al*., 2010) bear that anaemia in pregnancy increases with rising parity. However, this study like those of other researchers, (Mockenhaupt *et al*., 2015) revealed an inverse relationship between parity and anaemia. Following bivariate and multivariate analyses of potential determinants of anaemia, the women's gestational age at the time of the interview and women's age at the interview were identified as the only independent determinants of anaemia. Moreover, the majority of the respondents started ANC visit in the first trimester but the use of insecticide-treated bed nets was low and consequently, a third of them had malaria. Studies have revealed that malaria in pregnancy is associated with poor maternal and child health outcomes such as intrauterine growth retardation, preterm birth and low birth weight. Even though the majority had not experienced the symptoms yet, the mountainous nature of the town exposes the women to a variety of adverse consequences from malaria infection including maternal anaemia, placental accumulation of parasites, low birth weight and few are at risk of developing maternal anaemia (Steketee *et al*., 2001) just to mention a few. The presence of anaemia in this study is highest (36%) among respondents aged 27-33 years.

Globally, the prevalence of anaemia in pregnancy ranges from 41.8% – 43.8% (Tadesse *et al*., 2017). The variations may be attributed to different causes of anaemia, dietary differences, population differences, study design and differences in methodology used in determining haemoglobin levels. From these findings, it is evident that the prevalence of anaemia is very high despite the various interventions including health education during antenatal care. Anaemia was noted to be higher among pregnant women aged between 27– 33 years compared to women aged between 34 -39 years. This was significant at crude. However, after adjustment it was observed that women aged 27-33 years were three times more likely to be anaemic as compared to their counterparts in the age group 18-26 (OR: 3.0 at 95%CI). Similar studies have also shown a significant association between age groups and anaemia (Patil, 2013). In a report by (Chrispinus Siteti, 2014) from Kenya women aged between 21- 25 had the highest (43.3%) prevalence of anaemia.

CONCLUSIONS

The presence of anaemia among pregnant women attending Ho Municipal Hospital was 82% even though there was ongoing administration of iron supplementation, anti-helminthics and IPT to the pregnant women. The study also revealed that the age of pregnant women and gestational age were significantly associated with anaemia in pregnancy. Though the prevalence of anaemia was very high as compared to the WHO cut-off point, it was a mild public health problem. Also, the Majority of respondents were anaemic during their second trimester due to

haemodilution. Despite positive indications regarding the early initiation of antenatal visits, women commencing antenatal care after the first trimester are still at a higher risk for developing anaemia.

Authors' Contributions: This work was carried out in collaboration between all authors. SHA and CN-A participated in conceiving the study and in the development of data collection tools. SHA carried out data collection. SHA and CN-A participated in the data analysis and drafting of the manuscript. All authors read and approved the final manuscript.

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