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ANAEMIA IN PREGNANCY: THE PREVALENCE AND ASSOCIATED RISK FACTORS IN THE NKWANTA SOUTH MUNICIPALITY OF THE OTI REGION OF GHANA

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ABSTRACT

Background: Anaemia in pregnancy is found to be associated with poor pregnancy outcomes. This study was conducted to determine the prevalence of anaemia in pregnancy and the associated risk factors in the Nkwanta South Municipality in the Oti region of Ghana. **Material and Methods:** A cross-sectional descriptive study was conducted using systematic sampling technique. Antenatal records of all pregnant women who received antenatal care (ANC) points at the Nkwanta South Municipal Hospital from January 2019 to December 2019 were retrieved from the ANC register. A self-designed questionnaire was used to collect relevant data: maternal socio-demographic information, obstetric and antenatal history. The data was analysed using IBM SPSS version 21. Bivariate analysis and multinomial logistic regression of anaemia status and the various independent variables were conducted using 95% confidence interval. **Results:** The mean haemoglobin concentration for the study population was 10.2±1.5g/dL. The prevalence of anaemia (Hb<11g/d/l) in pregnancy at booking and 36 weeks were 67.4% (n=174 $p<0.001$) and 70.1% (n=54 p<0.001). There was no significant positive association between maternal height and anaemia in pregnancy. There were positive association between anaemia in pregnancy and maternal age (P=0.013), weight (P=0.001), BMI (P=0.007) and gestational age (P=0.006), all at booking. Gravidity (P=0.017) and parity (P=0.027) showed positive associations with anaemia at 36 weeks. Also, number of ANC visits (P=0.001) and number IPTp doses received during pregnancy showed significant positive association with anaemia in pregnancy. **Conclusion:** The study found a high prevalence of anaemia at booking and at 36 weeks of gestation. There were significant positive associations between anaemia in pregnancy and a number of maternal risk factors. There is the need to intensify maternal education on anaemia in pregnancy.

KEYWORS: Anaemia, pregnancy associations, risk factors, Oti Region, Ghana.

INTRODUCTION

Anaemia in pregnancy is defined as haemoglobin concentration of less than 11g/dL (WHO, 2011).[1] Although in pregnancy there is a physiological increase in plasma volume without an equiavalent increase in red cell mass, the haemoglobin and haematocrit levels are not expected to fall below the lower limit of the reference range.[2] Considering the dire consequences it poses to both the mother and the developing foetus, anaemia in pregnancy is a major public health concern.

Anaemia can be classified as mild, moderate and severe corresponding to haemoglobin levels: 10-10.9, 7-9.9 and <7 respectively (WHO, 20011).[1,2] According to the WHO decades ago, anaemia is of public health significance or problem if the prevalence is 5% or higher. Prevalence of anaemia ≥40% in any given population is a major public health problem (WHO, 2008).[1,2,3] Using WHO definition, the national prevalence of anaemia in Ghana at booking is estimated to be 36%.[3]

The causes of anaemia in pregnancy as reported in published literature globally include iron deficiency,

vitamin B12 deficiency, and folate deficiency and in some instances may be due to infestations by hookworm and plasmodium parasites.[1,2,3] Symptoms of anaemia in pregnancy include, dizziness, palpitations, easy fatigability, dyspnoea on exertion. If chronic, anaemia can have heart failure as a complication.

The prevalence of anaemia in pregnancy varies across the global depending on the sample size, location, methods and the study area[1,2,3,4,5] The global prevalence of anaemia in pregnancy according to WHO in 2011, was about 38.2%.[1] Seshadri[4] in India reported a prevalence of 87% among their study population. 4,775 pregnant women at more than 20 weeks of gestation. In Africa, Ayoga et al.,[5] in Mali, Wets Africa a rate of 47.0% in their study.

In Ghana, the Ghana Health service quotes the national prevalence of anaemia in pregnancy in 2016 to be approximately 36.0% with a marginal increase of about 1% over the 2015 rate.[3] They cited lack of compliance to Iron and Folic Acid (IFA) supplementation and inappropriate dosing of IFA among others as the major contributing factors to this high prevalence.[3]

The risk factors for anaemia in pregnancy reported by previous studies include maternal age, maternal body mass index (BMI), gravidity, parity, number of ANC visits, gestational age of first ANC visit, maternal height and the number of doses of malarial chemoprophylaxis received.[2,6,7] However, these factors have not been exutive or agreed my many researchers.

The government of Ghana years ago rolled out a number of policies to help reduce the incidence of anaemia in pregnancy and these includes but not limited to, maternal iron and folic acid supplementation (IFA), intermittent preventive treatment for malaria during pregnancy (IPTp) using sulphadoxine pyrimethamine and distribution of insecticide treated mosquito nets to pregnant women during antenatal care visits. The promotion of girl child education and female empowerment campaigns have contributed indirectly towards decreasing the incident of anaemia in pregnancy.

Problem statement

Anaemia in pregnancy is a common finding with documented increased risk of maternal mortality particularly in developing countries and therefore may hamper the attainment of sustainable development goal 3.

Anaemia among Antenatal Care (ANC) registrants in 2016 increased marginally, by about 1% over the 2015 rate. Issues of lack of compliance to IFA and appropriate dosing regimens as well as inadequate counselling (also linked to lack of compliance) have been cited as factors affecting anaemia prevention strategies; however empirical data for decision making in this area is lacking.[3]

Globally, maternal anaemia contributes to preterm delivery, and low birth weight and iron deficiency anaemia is implicated in 115,000 maternal deaths and 591,000 perinatal deaths each year.[6]

In the Nkwanta South district of the Oti Region of Ghana, the situation is similar to the national picture. The purpose of the study was to determine the prevalence of anaemia in pregnancy and the association with maternal age, gestational age, parity, birth spacing, and level of maternal education, BMI and number of antenatal care visits.

MATERIAL AND METHODS

STUDY AREA: Nkwanta South District

The Nkwanta south district is located in the Oti Region of Ghana. It has a population of about 117,878, 49.6% males and 50.4% females (2010 population census).[7] It is divided into four sub-districts with a total land area of 2,733km^2. It lies between longitude 0 10 and 0 45 east and latitude 7 30 and 8 45 North, bordered on the south by Kadjebi District, north by Nkwanta North District, west by Krachi East District, and the east by the Republic of Togo (DHS 2010).[7]

The major occupation of the residents is farming. The district has two forest reserves, the Kyabobo Range National Park. The district has a diverse composition with respect to ethnic groups and they include: Ntrubos, Atwodes, Adeles, Akans, Konkombas, Kotokolis, Challas, and the Basaris (DHS 2010).[7]

It has two hospitals serving its population, the Nkwanta South District Hospital and the St. Joseph's Hospital in addition to one health center, two clinics, two private clinics, and nine CHPS compounds.[3]

STUDY DESIGN

The study was cross-sectional with data extracted from the medical records of pregnant women who received antenatal care and delivered at the Nkwanta South Municipal Hospital from January, 2029 to December, 2019.

STUDY POPULATION

All pregnant women who attended antenatal clinic from January, 2019 to December, 2019 were included. Women who were not pregnant were excluded. The pregnant women were from various religious, social, and economic backgrounds.

SAMPLING TECHNIQUE

A systematic sampling technique was employed in retrieving antenatal records of all pregnant women who received antenatal care at the Nkwanta South Municipal Hospital during the study period. The first patient on the list was selected and subsequent ones selected by a fixed interval determined by the population size divided by the sample population. This method was chosen because it was convenient, and prevented selection bias. The

sample size was calculated using Taro Yamane's formula.

$$n = N/ [1+N (e) ^2]$$

Where; n= sample size, N= study population size, e = sampling error
N=740; n=260; e=0.05

DATA COLLECTION TECHNIQUE

This involved retrieval of maternal records from the ANC register. A self-designed guide was used in extracting maternal health information from the ANC attendance register for the period under consideration. The data extracted included maternal sociodemographic information, obstetric history and antenatal records.

DATA ANALYSIS

The data collected was inputted into IBM SPSS statistics version 21 for windows. The means for continuous variables were calculated, frequencies and percentages of categorical variables were also computed. Multinomial logistic regression and bivariate analysis of anaemia status and other variables were conducted. A 95% confidence interval was chosen and *p-value <0.05* as statistically significant.

ETHICAL CONSIDERATION

A formal letter of introduction from the Department of Community Health and family Medicine; School of Medicine, University for Development Studies, which detailed our activities was presented to the hospital. Also, in the letter was a request for permission and cooperation of the hospital for this activity. For all departments where data was taken for this study, a verbal consent was sought from the head of the department. Furthermore, administrative protocols were duly followed and patient's privacy and rights respected.

RESULTS

Age distribution of participants

A total of 260 pregnant women were part of this study. Their ages ranged from 14 to 48 years, with mean age of 26.83±6.8 years (C. I= 95%) and a median age of 26 years. The modal age group was 20-25 years (30%), **(Figure 1).**

Haemoglobin level of pregnant women at booking and subsequent visit

The total number of pregnant women whose haemoglobin level was checked at booking were 258 (99.2%) out of 260. Their haemoglobin levels ranged from 4.8 to 13.8g/dL, with a mean concentration of 10.2±1.5g/dL (C.I= 95%, n=258). Approximately 67.4% were classified as anaemic **(Table1).**

A total of 77 (29.6%) of the 260 pregnant women had their haemoglobin level checked at 36 weeks of gestation and this ranged from 7.6 to 14.4g/dL with a mean of 10.48±1.5g/dL (C.I= 95%, n=77). Approximately 70.1% were classified as anaemic **(Table1).**

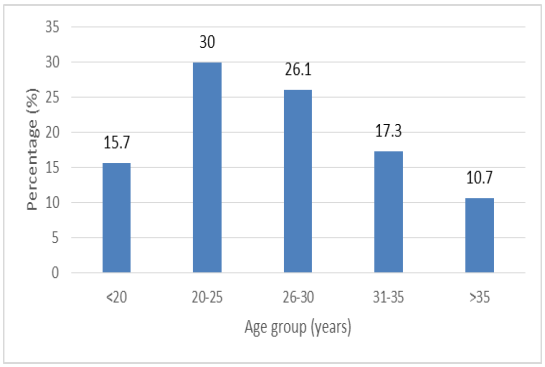

Figure 1: Age distribution of the pregnant women.

Table 1: Haemoglobin level of pregnant women at booking and 36 weeks.

HB at booking (g/dL)		Frequency (n)	Percentage (%)
	<7	4	1.5
	7-9.9	102	39.2
	10-10.9	68	26.2
	≥11	84	32.3
	Total	258	99.2
	Not checked	2	0.8
Total		260	100.0
HB at 36 weeks (g/dL)			
	7-9.9	24	9.2
	10-10.9	30	11.5
	≥11	23	8.8
	Total	77	29.6
	Not checked	183	70.4
Total		260	100.0

Height, weight and BMI of pregnant women

The height of the women ranged from 135-178cm, with a mean of 159±6.7cm (C. I= 95%, n=260), median height of 159cm, and the modal height of 160-200cm **(Table 2).** Similarly, the weight of the women ranged from 38-96kg, with a mean of 56.67±9.1kg (C. I=95%, n=260), a median of 23kg, and a modal weight of 30-59kg (65.8%), **(Table 2).** Also, the minimum and maximum

BMI of the pregnant women were 16.1kg/m^2 and 44.3kg/m^2 respectively. The mean BMI was 22.99±3.6kg/m^2 (C.I= 95%, n=260), with a median of 22.1kg/m^2 and a modal BMI of 18.5-24.9 kg/m^2 (73.5%), **(Table 2)**

Table 2: The height, weight, and BMI of study participants.

Height (m)	Frequency (n)	Percentage (%)
100-150	63	24.2
160-200	197	75.8
Total	260	100.0
Weight (kg)		
<60	171	65.8
60-70	65	25.0
71-80	20	7.7
81-90	2	.8
>90	2	.8
Total	260	100.0
BMI (kg/m^2)		
<18.5	13	5.0
18.5-24.9	191	73.5
25-30	43	16.5
>30	13	5.0
Total	260	100.0

Blood group of pregnant women

A total of 224 (86.9%) out of 260 women had their blood group determined during ANC visit. Approximately 36.6% were blood group O+, **(Table 3).**

Table 3: Blood group of study participants.

Blood group	Frequency (n)	Percentage (%)
a-	3	1.3
a+	46	20.5
ab+	16	7.1
b-	2	.8
b+	70	31.2
o-	5	2.2
o+	82	36.6
Total	224	100.0

Blood group and anaemia status at booking and 36 weeks of gestation

Blood group O+ had the highest number (21.3%) of anaemia cases at booking followed by B+ (18.2%), **(Table 4).** At 36 weeks, anaemia was equally prevalent among blood group O+ (29.8%), but followed by group A+ (14.2%) pregnant women **(Table 4).**

Table 4: Haemoglobin levels and blood groups of pregnant women at booking and at 36-weeks of gestation

Blood Group	Distribution at Booking				Total
	<7	7-9.9	10-10.9	≥11	
a-	0	0	0	3	3
a+	0	21	12	13	46
ab+	0	5	4	7	16
b-	0	1	1	0	2
b+	2	24	21	23	70
Na	1	19	6	8	36
o-	0	1	1	3	5
o+	1	31	23	27	82
Total	4	102	68	84	258
Blood Group	Distribution at 36 weeks				Total
		7-9.9	10-10.9	≥11	
a-		0	0	1	1
a+		5	6	6	17
ab+		2	0	1	3
b+		3	7	6	16
Na		1	4	2	7
o-		2	1	0	3
o+		11	12	7	30
Total		24	30	23	77

Gravidity and parity of pregnant women

The number of pregnancies ranged from 1 to11 with a mean of 3.25±2.2 (C.I=95%, n=25), and a median of 3. Approximately, 27.7% of the women were primigravida, **(Table 5).** The parity ranged from 0 to 10, with a mean of 1.92±1.2 (C.I= 95%, n=260), and a median of 2, **(Table 5)**

Table 5: Showing the gravidity and parity of participants.

Gravidity	Frequency (n)	Percentage (%)
1-3	163	62.7
4-6	73	28.1
7-9	22	8.5
10-12	2	.8
Total	260	100.0
Parity		
0-2	175	67.3
3-5	67	25.8
6-8	16	6.2
9-11	2	0.8
Total	260	100.0

Gestational age of booking visit and number of ANC visits

The minimum gestational age for booking visit was 4 weeks with a maximum of 41weeks. The mean gestational age at booking was 19.91±9.5 weeks (n=260), many were within 4-6 months of pregnancy (42.7%). The modal gestational age was 16-24 weeks (42.7%), the median is 19.91weeks, **(Table 6).**

The minimum and maximum numbers of ANC visit by the pregnant women were 1 and 11 with a mean of 2.32±1.9 (n=260), median of 1 and the modal group of 1-3 (80.8%), **(Table 6).**

Table 6: Gestational age of booking visit and number of ANC visits.

Gestational Age at booking (months)		Frequency	Percentage (%)
	1-3	82	31.5
	4-6	111	42.7
	7-9	67	25.8
	Total	260	100.0
Number of ANC visits			
	1-3	210	80.8
	4-6	34	13.1
	7-9	14	5.4
	10-12	2	.8
	Total	260	100.0

Sickling status of participants

A total of 100 (38.5%) of the pregnant women out of the 260 had their sickling status checked and all were negative. However, many (61.5%) did not do this test, (*p<0.001).*

Malaria chemoprophylaxis and accessibility of treated nets

Many 191 (73.5%) of the women received chemoprophylaxis for malaria compared to 69 (26.5%) who did not. (*p<0.001).* The mean number of doses received was 1.64±1.41 (n=191). A total of 65 (34%) had a single dose followed by those who had two doses, 58 (30%). A little above half, 147 (56.5%) of the study population were not given mosquito net during their ANC visit compared to 113 (43.5%) who were given.

Mosquito net distribution and haemoglobin level at booking visit and 36 weeks of gestation

At booking, 39.9% of those who were given ITN were anaemic compared to 27.5% for those who were not given, **(Table 7).**

At 36weeks, those who were given and those who were not given ITN had the same prevalence of anaemia (35%), **(Table 7).**

Table 7: Cross-tabulation of ITN distribution and Hb at booking and 36 weeks gestation.

ITN status	Booking Hb Levels (g/dl)				Total
	<7	7 -9.9	10 – 10.9	≥11	
Not given	31	67	33	42	145
Given		35	35	42	113
Total	4	102	68	84	258
ITN status	Hb levels (g/dl) at 36 weeks of gestation				Total
	7 – 9.9		10 – 10.9	≥11	
Not given		13	14	13	40
Given		11	16	10	37
Total		24	30	23	77

Association Between Haemoglobin Levels and Other Study Variables

Bivariate analysis and multinomial logistic regression of anaemia status and the various independent variables were conducted using 95% confidence interval.

Haemoglobin level and Age

There was no statistically significant association between the age of pregnant women and anaemia status at booking, *P=0.294 [(α=0.05), (95% C.I,* AOR=0.929 p=0.044 95%CI= 0.866-0.998*)]*. Women in the age group 20 to 25years had the highest cases of anaemia 57 (22) **(Table 8)**

However, at 36weeks, there was a stronger significant association between the age of the pregnant women and anaemia status, *P=0.013 [(α=0.01,* AOR=1.094, 95%CI=0.944-1.267*)]*. The age group 31 to 35years had the highest number of anaemia cases 18 (23.3%) **(Table 8).**

Table 8: Cross-tabulation of age and Hb levels at booking HB and 36 weeks of gestation.

Age (years)	Booking Hb level (g/dl)				Total
	<7	7 – 9.9	10 – 10.9	≥11	
<20	1	20	10	10	41
20 - 25	1	35	21	21	78
26 - 30	0	25	14	28	67
31 - 35	2	11	12	19	44
>35	0	11	11	6	28
Total	4	102	68	84	258
Age (years)	**Hb levels (g/dl) at 36 weeks of gestation**				**Total**
		7 – 9.9	10 – 10.8	≥11	
<20		2	5	6	13
20 - 25		4	7	6	17
26 - 30		6	6	8	20
31 - 35		9	9	3	21
>35		3	3	0	6
Total		24	30	23	77

Association between the haemoglobin level and height, weight, and BMI of pregnant women

There was no significant association between anaemia status and the height of the pregnant women *P=0.073[(α=0.05), (*AOR=1.022 p=0.628, 95%CI=0.936-1.115*)]*. There was also no significant association between the height of the pregnant women and anaemia status at 36 weeks of gestation *P=0.434 [(α=0.05,* AOR=0.668, 95%CI=0.401-1.111*)]* **(Table 9).**

There was however a strong positive association between the weight of the pregnant women and anaemia status at booking, *P=0.001 (α=0.05), (*AOR=0.933 p=0.2, 95%CI=0.838-1.038*)*. At 36weeks, there was no significant association between weight and anaemia status, *P=0.434 [(α=0.05), (*AOR=0.668, 95%CI=0.401-1.111*)]*.

There was a strong positive association between BMI and anaemia status at booking *P=0.007 [(α=0.05)(*AOR=1.048 p=0.726, 95%CI=0.807-1.360*)]*, but no association between BMI and anaemia status at 36 weeks *P=0.939 [(α=0.05)(*AOR=0.298, 95%CI=0.054-1.654**)] (Table 9 and 10).**

Table 9: Cross-tabulation of height (m), weight (kg), BMI (%) and booking Hb levels (g/dl).

Height		Booking Hb				Total
		<7	7-9.9	10-10.9	≥11	
	1-1.5	1	31	15	15	62
	1.6-2	3	71	53	69	196
Total		4	102	68	84	258
Weight		Booking Hb				Total
		<7	7-9.9	10-10.9	≥11	
	<60	3	82	43	42	170
	60-70	1	18	17	29	65
	71-80	0	1	7	12	20
	81-90	0	0	1	0	1
	>90	0	1	0	1	2
Total		4	102	68	84	258
BMI		Booking Hb				Total
		<7	7-9.9	10-10.9	≥11	
	<18.5	0	5	2	6	13
	18.5-24.9	3	85	50	52	190
	25-30	1	9	14	19	43
	>30	0	3	2	7	12
Total		4	102	68	84	258

Table 10: Cross-tabulation of height (m), weight (kg), BMI (%) and Hb levels (g/dl) at 36 weeks.

Height		Hb at 36 weeks			Total
		7-9.9	10-10.9	≥11	
	1-1.5	8	6	5	19
	1.6-2	16	24	18	58
Total		24	30	23	77
Weight	**Hb at 36 weeks**				**Total**
	7-9.9		**10-10.9**	**≥11**	
	<60	17	17	14	48
	60-70	4	9	5	18
	71-80	2	3	4	9
	81-90	1	1	0	2
Total	24		30	23	77
BMI	**Hb at 36 weeks**				**Total**
		7-9.9	**10-10.9**	**≥11**	
	<18.5	1	0	2	3
	18.5-24.9	18	21	15	54
	25-30	3	7	5	15
	>30	2	2	1	5
Total		24	30	23	77

Gravidity and Haemoglobin level at booking and 36weeks

There was no statistically significant association between the gravidity of pregnant women and being anaemic at booking, *P=0.429 [(α=0.05)(*AOR=1.060 p=0.783, 95%CI=0.702-1.599*)]* **(Table 11).** However, there was an association between gravidity and anaemia status at 36 weeks *P=0.017 [(α=0.05,* AOR=1.094, 95%CI=0.318-3.763*)]*, **(Table 11).**

Table 11: Cross-tabulation of gravidity and Hb (g/dl) at booking and 36 weeks gestation.

Gravidity	Booking Hb levels (g/dl)				Total
	<7	7 – 9.9	10 – 10.9	≥11	
1 - 3	2	68	34	58	162
4 - 6	2	24	26	20	72
7 - 9	0	10	6	6	22
10 - 12	0	0	2	0	2
Total	4	102	68	84	258
Gravidity	**Hb levels (g/dl) at 36 weeks gestation**				Total
		7 – 9.9	10 – 10.9	≥11	
1 - 3		15	17	17	49
4 - 6		7	10	6	23
7 - 9		2	3	0	5
Total		24	30	23	77

Parity and Haemoglobin level at booking and 36 weeks

There was no statistically significant association between the parity of pregnant women and being anaemic at booking, *P=0.183 [(α=0.05)(*AOR=1.244 p=0.384, 95%CI=0.784-1.971*)]* **(Table 12).** However, there was a significant association at 36 weeks *P=0.027 (α=0.05,* AOR=1.011, 95%CI=0.283-3.608*),* **(Table 12).**

Table 12: Cross-tabulation of parity and Hb (g/dl) at booking and 36 weeks gestation.

Parity	Booking Hb levels (g/dl)				Total
	<7	7 – 9.9	10 – 10.9	≥11	
0 -2	2	70	39	63	174
3 - 5	2	26	21	17	66
6 - 8	0	6	6	4	16
9 - 11	0	0	2	0	2
Total	4	102	68	84	258
Parity	**Hb levels (g/dl) at 36 weeks gestation**				**Total**
		7- 9.9	10 – 10.9	≥11	
0 – 2		15	18	18	51
3 - 5		8	9	5	22
6 - 8		1	3	0	4
Total		24	30	23	77

Gestational age of first ANC visit and haemoglobin level at booking and 36 weeks

There was a very strong statistical association between the gestational age of first ANC visit and being anaemic at booking, *P=0.006 [(α=0.01)(* AOR=1.023 p=0.233, 95%CI=0.985-1.063*)]* **(Table 13).** However, there was no significant association between gestational age of first visit and anaemia status at 36weeks *P=0.763 [(α=0.05,* AOR=0.992, 95%CI=0.917-1.074*)]* **(Table 13).**

Table 13: Cross-tabulation of gestational age at booking and 36 weeks Hb levels (g/dl).

Gestational age(Months)	Booking Hb				Total
	<7	7- 9.9	10 – 10.9	≥11	
1 - 3	0	18	22	40	80
4 - 6	3	53	29	26	111
7 - 9	1	31	17	18	67
Total	4	102	68	84	258
Gestational age (months)	**Hb at 36 weeks of gestation**				**Total**
		7 – 9.9	10 -10.9	≥11	
1 -3		7	12	6	25
4 - 6		8	13	13	34
7 – 9		9	5	4	18
Total		24	30	23	77

Number of ANC visits and haemoglobin level at booking and 36weeks

There was a very strong association between the number of ANC visits and being anaemic in pregnancy *P=0.001 [(α=0.05)(*AOR=0.850 p=0.212, 95%CI=0.658-1.098*)]*, **(Table 14).**

Table 14: Cross-tabulation of number of ANC visits and Hb levels (g/dl) in pregnancy.

Number of visits	Hb levels				Total
	<7	7 – 9.9	10 – 10.9	≥11	
1 - 3	4	93	56	55	208
4 - 6	0	7	8	19	34
7 - 9	0	2	4	8	14
10 - 12	0	0	0	2	2
Total	4	102	68	84	258

Number of IPTp doses and haemoglobin level

There was a very strong association between the number of ANC doses of IPTp received and being anaemic at during the period of pregnancy, *P=0.001 [(α=0.05) (*AOR=0.935 p=0.674, 95%CI=0.683-1.280*)]*, **(Table 15).**

Table 15: Cross-tabulation of IPTp doses and Hb levels (g/dl) during pregnancy.

ITPp Doses	Hb levels				Total
	<7	7 – 9.9	10 – 10.9	≥11	
0	1	28	17	21	67
1	1	36	15	13	65
2	2	21	18	17	58
3	0	12	11	13	36
4	0	4	7	11	22
5	0	1	0	9	10
Total	4	102	68	84	258

DISCUSSION

Prevalence of anaemia in pregnancy

The current study conducted among pregnant women within the Nkwanta south district in the Oti Region of Ghana, found a mean haemoglobin concentration at booking to be 10.2±1.5g/dL (n=258). This is similar to 10.9±1.3g/dL found by Acheampong et al.,[8] in Accra, Ghana and the 10.2±1.3g/dL, (n=350), reported by Ugwuja et al.,[9] in Nigeria. The observed similarities in our opinion may be attributed to the common sociodemographic characteristic among the study populations in these study areas.

At the booking visit, approximately, 67.4% of the pregnant women were anaemic. This is higher than the prevalence rate of 38.2% reported globally[1], and those reported in previous studies in Ghana.[3,8,9] For instance, Acheampong et al.,[8] reported a prevalence of 51% in Accra. This observed lower prevalence may be due to the fact that these regions have a higher ANC attendance than our study area. Furthermore, lower rates are similarly reported in other parts of Africa and Palestine.[10,11,12] In Nigeria, Esike et al.,[10] reported a prevalence of 56.0%, while Khader et al.,[11] reported a prevalence of 38·6% in the occupied Palestinian territory. However, the prevalence in our study population is closer to the 63.8% reported by Bereka et al.,[12] in the Jigjiga city of Eastern Ethiopia. It is equally important to know that our prevalence rate of 67.3% was in fact better that rates in other African countries.[4,13,14] In 2005, Idowu et al.,[13] reported a prevalence rate of 76.5% in Abeokuta, while Baig-Ansari et al.,[14] reported a rate of 90.5% in Pakistan.

At 36 weeks gestation the mean haemoglobin level was10.48±1.5g/dL (n=77) which is similar to the mean value for the haemoglobin level during first ANC visit. We found the prevalence of anaemia among subjects to be 70.2% (n=54). This percentage is close to our finding

at booking. This finding may be attributed to the fact that ANC attendance by the women in our study was low, compared to other parts of the World.[14,15] It may also be that the pregnant women were following the directives given at ANC visits, or the treatment with iron supplements was not effective, as reported in some previous studies in West Africa[16,17] and Palestine.[18]

Height and anaemia in pregnancy

The mean height for the pregnant women in this current study was 159±6.7cm (n=260) and this is relatively lower than the 166.1cm reported in Mogren[19] study in Sweden. The difference observed may be due to better standards of living in Sweden. There was no positive associations with maternal height at booking, (*P=0.073).* This differs from Baig-Ansari et al., who reported in their study that, anaemia in pregnancy was less common in tall women.[14]

Age and anaemia in pregnancy

The mean age for the pregnant women in this current study was 26.83±6.8 years (n=260) which is similar to the 27.1±4.6 years reported by Ugwuja et al.,[9] in Nigeria (n=350) and the 26.3±5.9 years by Srour et al.,[18] in Palestine (n=300). Our mean age was relatively younger that the 30.75 years reported in recent study by Mogrenet al.,[19] in Sweden. This may be due to the fact that most of the women in Sweden do not marry or give birth early because of education and their careers demands.

From our study, there was no statistically significant association between the age of study population and the prevalence of anaemia at booking, *(P=0.294).* This finding differs from the results of recent past studies in some parts of Africa that reported some significant statistical associations between the age of a pregnant woman and the booking haemoglobin levels. For instance, Anlaaku et al.,[15] in the Brong-Ahafo region of Ghana (p=0.017) and Shitie et al.,[20] in Ethiopia (*p<0.05)* all reported statistically significant relationship between age and anaemia status in the pregnant women at booking. Pregnant women in our study who were less than 26 years had a higher prevalence of anaemia per age group and also recorded the greatest percentage of the total number of anaemia case. This may be attributed to the fact that majority of them were nulliparous, so they have not received any prior ANC education on anaemia in pregnancy and how to prevent it.

Parity and anaemia in pregnancy

The mean parity of 1.92±2.0 (n=260), was observed in this current study. Ugwuja et al.,[9] reported a similar value of 1.64±2 (n=350) in Nigeria. This similarity may be due to the fact that there is similar reproductive health-seeking behavior among women in both study areas. There was no statistically significant relationship between the parity of pregnant women in this current study and their haemoglobin level at booking, (*P=0.183).* This is consistent with findings by Anlaaku et al.,[15] in Sunyani Ghana, who similarly found no association between parity and haemoglobin concentration at the booking visit (*p=0.230).* The parity range, 0-2 has a prevalence of 63.7% and this is 63.7% of the total number of anaemia cases. A study by Kofie et al.,[21] in the Hohoe municipality of the Volta Region of Ghana revealed that pregnant women with parity of 0 and 1-2 had the highest percentage of anaemia cases (39% for each category, n=52 for each category).

Gravidity and anaemia in pregnancy

The mean gravidity was 3.25±2.2 (n=260), and that, pregnant women in the gravidity range, 1-3 had 64.1%. Furthermore, the current study did not find any significant positive association between the gravidity and haemoglobin concentration at booking, (*P=0.429).* These values are differ from those reported previously in Ghana and Korea.[21,22] For instance, Lee et al., reported a mean of 2.1±1.3[22] among women in Korea. Much lower than the 3.3±2.2 in this current study.

Weight and anaemia in pregnancy

The mean weight of the sample population was 56.67±9.1kg (n=260). We found a strong relationship between the weight of participants and anaemia in pregnancy at booking, (*P=.001).* At booking, 73.5% of subjects who were anaemic weighed less than 60kg. This may be due to the fact that most of these persons were underweight possibly due to under nutrition. The current finding is in line with Tan et al.,[23] study in Chine who identified low pre-pregnancy maternal weight as risk factor for anaemia in pregnancy. However, Cao et al.,[24] did not find any negative impact of pre-pregnancy maternal with increased risk of anaemia in pregnancy.

BMI and anaemia in pregnancy

The potential impact of body weight on anaemia, particularly iron deficiency anaemia has not been well investigated in Ghana. Again, maternal weight indicators, including pre-pregnancy body mass index (BMI) and gestational weight gain (GWG), represent important measures of maternal metabolism and nutritional situation.[25,26] Currently, only a few studies examined the association between maternal weight indicators and risk of IDA, globally with different outcomes.[27,28]

The current study conducted within the northern part of Ghana reported a mean BMI for the pregnant women as 22.99±3.6kg/m^2 (n=260). This is relatively lower than the values of some reports across the world.[9,18,,23,27,28] We found a statistically significant relationship between the BMI of pregnant women and anaemia at booking, (*P=.007),* this was more so with those in the range 18.5-24.95kg/m^2 recording a prevalence of 72.6% and this was 79.3% of the total number of cases. This support's some previous studies[23,26], but differs from other reports[18,28] across the gloe. For instance, Srour[8] did not find a statistically significant relationship between anaemia and the BMI of pregnant women, *p=0.*250 among Palestinian

women, furthermore, Jones et al.,[28] in there study in 2016, did not report significant association.

Gestational age of first ANC attendance and anaemia in pregnancy

The mean gestational age of first ANC booking was 19.91±9.5 weeks (n=260). Owusu-Boateng[29] in Ghana, reported a lower mean of 15.9±6.4 weeks (n=255). Ewunetie et al.,[30] in Ethiopia reported a mean of 14.5±6.5 weeks (n=250), while Turyasiima et al.,[31] in Northern Uganda, reported a mean of 22.6±5.7weeks (n=417), relatively higher than that of the current study. Our study found a statistically significant relationship between the gestational age of first ANC visit and the haemoglobin level at booking, (*P=.006).* Anlaaku[15] in Sunyani, Ghana, also reported a significant statistical relationship, *p=0.016.* Those who went for ANC in the first trimester recorded an incidence of anaemia of 50%, those who went in the second trimester had an incidence of 76.5%, while pregnant women who went in the third trimester had an incidence of 73.1%. This may be attributed to the fact those who attended ANC for the first time in the second and third trimesters were less concerned about their health hence the higher incidence of anaemia.

Number of ANC attendance and anaemia in pregnancy

The mean number of ANC attendance was 2.32±1.9 (n=260). Ugwuja et al.,[9] in neighbouring Nigeria, reported a mean of 7.0±2.5 (n=350), three times the finding in our study. Furthermore, Owusu-Boateng[29] in same country Ghana found a mean parity of 4.9±1.4. Again, in the Brong Ahafo region of Ghana, a closed region that shares common sociodemographic features, the mean according to the 2016 GHS annual report[32] was 4.8, which is also higher than our value. The observed low number of ANC attendance in the current study may be due to poor health-seeking behaviour among these women. We found a statistically significant relationship between the number of ANC visit and the haemoglobin level at booking, (*P=0.001),* but at 36 weeks of gestation. This disagreed with Ikeanyi et al[33] in Nigeria, who found strong association ($p<0.0001$) between number of ANC visits and anaemia in pregnancy. This however is in line with Stephen et al.,[34] in Tanzania who reported a drop in the percentage of anaemia among pregnant women with ANC attendance of 4 or more**.**

CONCLUSION

The prevalence of anaemia in pregnancy at booking and 36weeks was were significantly high. In this study, five main maternal variables: weight, BMI, Gestational age of first ANC visit, Number of ANC visits during pregnancy, and the number of doses of malaria chemoprophylaxis (ITPp) received, were found to be significantly associated with anaemia in pregnancy. On the other hand; age, height, gravidity, and parity did not have a significant association with anaemia in pregnancy.

STUDY LIMITATION

The major limitation to this study was that it involved the use of maternal records in data collection and not an interaction with the patients themselves so a lot of other factors such a maternal nutrition which may have contributed to the prevalence of anaemia could not be assessed because the data was not available in the maternal records book.

RECOMMENDATIONS

1. Prevalence of anaemia in pregnancy

The Ghana Health Service (GHS) should intensify its supervision of health care workers in the Nkwanta South Municipality to ensure they are enforcing strictly the policies implemented to help curb anaemia in pregnancy in the municipality. Also, GHS through the municipal health directorate should organize community durbars and outreaches to the various communities in the municipality to educate the stakeholders, pregnant women and their husbands on anaemia in pregnancy and its prevention.

2. Gravidity and parity of women

Midwives should educate pregnant women during ANC visits on family planning and methods of contraception and help those who express interest to make an informed choice in order to help reduce gravidity and parity, improve birth spacing, maternal and child health.

3. ANC visit

The Ghana Health Service through the municipal health directorate should organize durbars to educate women and their spouses on the importance of early ANC visit when the woman is pregnant, attending ANC according to schedule, and also to encourage husbands to accompany their wives during ANC visits.

4. Malaria chemoprophylaxis

GHS should ensure uninterrupted supply of malaria chemoprophylaxis and midwives should also educate pregnant women on the need to take them religiously.

5. Insecticide Treated Nets (ITN) Distribution.

The district health directorate should embark on community outreaches to ensure the pregnant women have fixed the mosquito nets given them at ANC and also educate them on its relevance.

DECLARATIONS

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Conflict of interest: We have no conflict of interest to declare.

Ethical consideration: A formal letter of introduction from the University which detailed our activities was presented to the hospital. All in the letter was a request for permission and cooperation of the hospital for this activity. For all departments where data was taken for this study, a verbal consent was sought from the head of the department. All administrative protocols were duly followed and patient's privacy and rights respected.

Availability of data and materials: The data used in the preparation of this manuscript shall be made available when requested.

Author's contributions: Nyame F.K.U, Otuo S.E, and Der E.M conceptualised the idea and pattern of the manuscript. Nyame F.K.U and Otuo S.E collected the data, analysed and drafted the manuscript. Nyame F.K.U, Otuo S.E, and Der E.M read through the manuscript, edited it and approved the manuscript for publication

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