International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Factors Associated with Prenatal Anemia in the Yilo Krobo Municipality of Ghana

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Abstract

Anemia in pregnancy is a common public health problem and associated with high rates of mortality and morbidity in pregnant women as well as perinatal mortality. It is crucial to identify risk factors of prenatal anemia so interventions can be designed to address them. The aim of this study is to determine factors associated with anemia in pregnancy in Yilo Krobo Municipality. An unmatched case-control study was conducted among 110 (55 cases and 55 controls) pregnant women attending antenatal clinics in health facilities in the Municipality from June to December 2012. Socio-demographic, antenatal, infective and dietary data of study participants were collected using structured questionnaires. Data were analyzed using Epi Info 3.5.4. Bivariate and multivariate analyses were computed. Bivariate analysis shows a positive association between having prenatal anemia and having no formal education (OR-2.6, p-value 0.04), increased in birth spacing more than 5years (OR-3.06 p-value 0.029), herbal medicine intake (OR-4.0 p-value 0.008), parity of more than three children (OR-2.9, p-value 0.01) and owning insecticide treated nets (OR-0.359, p-value 0.023). Multivariate analysis shows significant association between herbal medicine intake (OR-3.14, p-value 0.031) and prenatal anemia. Prenatal anemia is therefore significantly associated with herbal medicine intake during pregnancy.

Keywords: Africa; Anemia; Ghana; Prenatal; Risk factor; Yilo Krobo.

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1. Introduction

Anemia during pregnancy is a global public health challenge facing the world today, especially in the developing countries. Anemia in pregnancy is an important contributor to maternal mortality and morbidity as well as to the low birth weight which in turn might contribute to infant mortality. Maternal anemia results in morbidity and mortality in both the mother and the unborn child [1]. During pregnancy anemia may lead to hemorrhage, puerperal infection, thromboembolic problems, premature labor, low birth weight and maternal and perinatal mortality [2]. According to WHO criteria, anemia in pregnant women is defined as a hemoglobin concentration of less than 11 g/dl in the blood. Based on this criterion more than half of pregnant women in the world have hemoglobin levels indicative of anemia and many of these women were anemic at the time of conception [1,3]. The Nutrition Impact Model Study's 2011 estimates that the worldwide prevalence of anemia in pregnant women was 38% (95% C.I 33% -43%), translating into 32 (28 to 36) million pregnant women globally [4]. Because of the persistently high burden of disease, the World Health Organization has long recommended the prenatal use of iron supplements in low and middle income countries, and this is also recommended in many high income countries [5]. Moreover iron deficiency is the most widespread nutritional deficiency in the world. It is the most common cause of anemia during pregnancy. In 2011 more than 50% of anemia in pregnant women was due to iron deficiency in regions where fewer other causes were present. Other causes include parasitic diseases such as malaria, hookworm infections, and schistosomiasis; micronutrient deficiencies including folic acid, vitamin A, and vitamin B12; and genetically inherited hemoglobinopathies such as thalassemia [6]. In sub-Saharan Africa, a high prevalence (95.4%) of anemia has been reported among pregnant women with the mean prevalence of maternal anemia in the sub region estimated to be 61% [7]. Pregnant women are particularly susceptible to malaria in endemic populations and often have higher prevalence and severe form of malaria including anemia [8] and changes in the immune system associated with pregnancy have been suggested as the reason for this [9]. Hookworm infections on the other hand impair micronutrient absorption thus increasing the susceptibility of pregnant women to anemia [10]. Recently, infection with HIV has emerged as an additional important risk factor for anemia in pregnancy [11]. In Ghana, anemia is common among children under five years and pregnant women with a prevalence in pregnancy estimated as hemoglobin less than 11g/dl being 70% [12] and severely anemia as hemoglobin level of less than 7g/dl. Anemia in pregnancy contributes to about 20% to maternal deaths [13]. The aim of this study is to determine factors associated with anemia in pregnancy in Yilo Krobo Municipality.

2. Methods

2.1 Study site

The study was conducted in Yilo Krobo Municipality in the Eastern Region of Ghana with a population of 95,462 and expected pregnancies of 3818. Prevalence of anemia among pregnant women is 36% [14] and the municipality is a malaria endemic and a high HIV prevalence area. There are a total of twenty five health facilities made up of one polyclinic, ten health centres, five clinics and nine community health and planning services (CHPS) compounds. During the year 2012, the number of pregnant women who attended antenatal clinics in the health facilities within the municipality were 2665. Antenatal services are provided by all the

facilities in the Municipality.

2.2 Study design

An unmatched case-control study was conducted between June to December 2012 among pregnant women in their third trimester who attended health facilities within the Municipality. Pregnant women were grouped into cases and controls using the WHO definition for diagnosis of anemia in pregnancy. Pregnant women who attend antenatal clinics are routinely provided with a range of services and interventions which include laboratory tests such as hemoglobin, urine and stool tests. The results of these test, vital signs and treatments are all documented in their antenatal cards as well as health facility records. Cases were defined as pregnant women in their third trimester with hemoglobin level of less than 11g/dl and controls were pregnant women in the third trimester with hemoglobin level of 11g/dl and above. The inclusion criteria were pregnant women in their third trimester who attended health facilities within the Municipality and were willing to participate in the study.

2.3 Sample size determination

Sample size calculations were conducted in the StatCalc module of EpiInfo [15]. The following assumptions were considered to determine the sample size, prevalence of 36% of anemia from the Municipal report, confidence interval of 95%, power of 80% and least extreme Odd Ratio of 3, a total sample size of 110 respondents, 55 cases and 55 controls were arrived at.

2.4 Sampling technique

A list of all pregnant women who attended facilities in 2012 within the municipality were made with their hemoglobin levels extracted from facility records in addition to age, trimester of pregnancy and facility of attendance to form a sample frame. Stata version 12 was used to randomly select 55 cases with hemoglobin less than 11g/dl who are in the third trimester and 55 controls with similar characteristics except for hemoglobin level of more than or equal to 11g/dl. The selected pregnant women were identified and information about the study was presented to them. Structured questionnaires on various risk factors namely socio demographic, antenatal, dietary and infective factors were administered to both the cases and controls after informed consent was sought. Antenatal record books were examined to obtain some missing information.

2.5 Ethical considerations

Permission was received from the Municipal Health Management team, health facility managers and Ghana college of Physicians and Surgeons gave clearance for the study to be conducted. Written informed consent was sought from the study participants.

2.6 Data collection procedure

Data were collected on face-to-face interview bases using well-structured questionnaires and reviewing the antenatal care follow up record cards of each pregnant woman who gave their consent to participate in the study.

The questionnaire gathers four groups of participants' characteristics, namely socio-demographic, antenatal factors, dietary and infections. The antenatal care cards of each pregnant woman who gave their consent were reviewed to obtain their hemoglobin test results of their previous visit to antenatal care clinics and their medical history in the day of questionnaire administration.

2.7 Data analysis

The data was entered into Epi info version 3.5.4 2012 and analysis was done using the same software. Univariate analysis to determine frequencies of various variables were conducted and outcome variables were dichotomized into 1=cases and 0=controls and two steps (Bivariate and Multivariate) logistic regression analysis was implemented. To investigate the strength of association between dependent and independent variables crude and adjusted odds ratio were computed at 95% confidence interval and p-value <0.05 for statistical significance.

3. Results

Table 1: Socio-Demographic Characteristics

VARIABLE	**CATEGORY**	**RESPONDENTS**	
		FREQ	%
Occupation	Unemployed	17	15.5
	Self employed	62	56.4
	Farmer	25	22.6
	Formal sector worker	6	5.4
Educational level	**None**	**26**	**23.6**
	Primary/JSS	62	56.4
	Secondary/Vocational	14	12.7
	Tertiary	4	3.6
Marital Status	Married	48	43.6
	Single	30	27.3
	Widowed	9	8.2
	Co-habiting	23	20.9
Age of respondents	14-25	46	41.8
	26-35	53	48.2
	36-45	11	10

Table 2: Socio-economic and Antenatal Factors

VARIABLE	**CATEGORY**			**OR**	**p-value**
		CASES N=%	**CONTROLS N=%**		
Occupation	No job	8 (53.3)	9 (46.6)	0.87	0.7
	Traders	27(61.4)	17(38.6)	2.15	0.079
	Hairdressers	3 (30)	7 (70)	0.39	0.31
	Seamstress	3(37.5)	5(62.5)	0.57	0.71
	Farmer	12(48)	13(52)	0.90	1.00
	Formal sector work	2(33.3)	4(66.6)	0.48	0.67
Educational level	**No formal education**	**18(69.2)**	**8 (30.8)**	**2.6**	**0.041**
	Primary/JSS	27(29.3)	35(70.9)	1.80	0.178
	Secondary/Vocational	9(64.3)	5(35.7)	0.74	0.390
	Tertiary	1(25)	3(75)	0.26	0.600
Age of respondents	14-25	18(39.1)	28(60.8)	3.03	0.08
	26-35	30(56.6)	23 (43.4)	1.31	0.25
	36-45	7(63.6)	4 (36.3)	0.09	0,79
Place of Antenatal Care	Community Clinic	1(33.3)	2(66.7)	1.42	0.234
	Health Centre	28(42)	34(58)	0.92	0.340
	Hospital/Polyclinic	18(50)	18(50)	0.041	0.830
	Private midwife	1(50)	1(50)	0.51	0.47
	Home/TBAs	7(100)	0(0)		
Parity	0	15(48.3)	16(51.7)	0.04	0.5
	1-2	20(41.6)	28(58.3)	1.8	0.08
	3 or more	**17(70.9)**	**7(29.1)**	**2.9**	**0.0178**
Gravida	1-2	22(42.3)	30(57.7)	1.56	0.2
	3-4	20(47.6)	22(52.4)	0.07	0.7
	5-6	12(80)	3(20)	2.5	0.11
Birth Spacing	<1	2(66.7)	1(33.3)	2.04	0.56
	1-1.9	3(60)	2(30)	1.52	0.64
	2-2.9	9(42.8)	12(57.1)	0.70	0.627
	3-3.9	12(57.1)	9(42,8)	1.42	0.620
	4-4.9	2(33.3)	4(66.7)	0.38	0.43
	>5	**15(75)**	**5(15)**	**3.06**	**0.029**

Age of Pregnancy Before attending ANC	1-2mths	17(53)	15(47)	0.04	0.83
	3-4mths	24(55.8)	19(44.2)	0.61	0.43
	5-6mths	12(41.4)	17()58.6	0.75	0.380
	7-8mths	2(40)	3(60)	0.21	0.650
Number of times for	>7times	6(46.2)	7(53.8)	0.08	0.76
ANC attendance	1-2times	13(52)	12(48)	0.05	0.82
	3-4times	19(48.7)	20(51.3)	0.04	0.80
	5-6times	17(51.5)	16(48.5)	0.04	0.83
Medicine intake	**Herbal products**	**20(80)**	**5(20)**	**4.00**	**0.008**
Including haematenics	Fersolate	33(50.7)	32(49.3)	0.03	0.84
	Eleron	8(50)	8(50)	0.07	0.78
	Folic acid	12(44.4)	15(55.6)	0.19	0.65
	Polyfer/Rovite	19(52.7)	17(47.2)	0.04	0.84
Length of time on	1-2mths	22(61.1)	14(38.8)	2.02	0.155
haematenics	3-4mths	18(45)	22(55)	0.35	0.550
	5-6mths	13(52)	12(48)	0.05	0.820
	>6mths	1(20)	4(80)	0.84	0.17
Bleeding during	Yes	5	3	0.13	0.71
pregnancy	No	50	52		

The total number of respondents were 110 and the age of respondents range between 14 to 45 years with 48.1% of them between age 14 to 25 years and 10% between 36 to 45 years old. Majority of the respondents were self-employed (56.4%) while only 5.4% were formal sector workers.

More than half (56.4%) of respondents had primary or junior secondary level education with 23.6% having no formal education.

Respondents who were married form 43.6% and those co-habiting was 20.9%. Socio economic and antenatal factors affect prenatal anemia. Prenatal mothers with no formal education who had anemia was 69.2 % compared with 30.8% (n=26) of no formal education among the control group.

Pregnant women with no formal education were two to three times more likely to have prenatal anemia than the controls and this relationship is significant. (OR 2.6, p=0.041). 70.9% of women with parity of 3 or more had prenatal anemia compared with 29.1% (n=24) of women with the same parity who did not have prenatal anemia, an association exist between mothers with three or more children and prenatal anemia (OR 2.9, p=0.017). 75% of pregnant women with birth spacing of more than 5 years have prenatal anemia compared with 15% of women

with birth spacing of more than five years among the controls.

Birth spacing of more than five years is associated with prenatal anemia (OR 3.06, p=0.029). 80% of women who take herbal preparations had prenatal anemia compared with 20% (n=25) of women who take herbal preparation and yet do not have anemia. Majority of women who take herbal preparations had prenatal anemia, association exist between those who take herbal preparations and prenatal anemia (OR 4.00, p=0.008).

Other factors such as age of respondents, place of receiving antenatal care, occupation, gravidity and age of pregnancy before receiving antenatal care do not have any association with prenatal anemia. (Table 2)

Table 3: Infections and Infestations

VARIABLE	**CATEGORY**			**OR**	**p-value**
		Cases **N=%**	**Control** **N=%**		
Receiving Anti-malarials	Yes	14(45.2)	17(54.8)	0.35	0.54
after the attack	No	1(50)	1(50)		
Intake of SP during	Yes	48(50)	48(50)	0.08	0.77
Pregnancy	No	7(50)	7(50)		
Doses of SP taken	First dose	8(53.3)	7(46.7)	0.077	0.78
	Second dose	25(56.8)	19(43.2)	0.94	0.33
	Third dose	15(42.9)	20(57.1)	0.67	0.41
ITN Ownership	**Yes**	**37(43.5)**	**48(56.5)**	**0.359**	**0.023**
	No	15(68)	7(32)		
Usage of ITN	Yes	26(42.6)	35(53.4)	0.55	0.12
	No	27(57.4)	20(42.6)		
Received Deworming	Yes	36(53.7)	31(42.3)	0.61	0.43
Tablets	No	18(42.9)	24(57.1)		
HIV Status	Yes	1(12.5)	7(87.5)	0.13	0.028
	No	50(51.5)	47(48.5)		

The ownership of insecticide treated nets (ITN) which is to prevent malaria infection was assessed and 56.5% of controls owned ITN compared to 43.5% (n=85) of cases who owned ITN.

There is a significant association between owning an ITN and not having prenatal anemia, that is ITN ownership has a protective effect (OR 0.359, p=0.023). Other factors such as deworming, HIV status do not have association with prenatal anemia. (Table 3)

Table 4: Dietary Factors

VARIABLE	CATEGORY	Status, n(%)		OR	p-value
		CASES	CONTROLS		
Decision on diet	Husband	10(58.8)	7(41.2)	0.28	0.597
	Mother/Mother-in-law	15(46.9)	17(53.1)	0.174	0.676
	Herself	31(52.5)	28(47.5)	0.145	0.703
Carbohydrate intake	Rice	26(47.3)	29(52.7)	0.145	0.703
	Fufu/Banku	53(49.5)	54(50.5)	0.339	0.560
	Yam/Plantain	25(43.9)	32(56.1)	1.3	0.25
	Tuozafi, Konkonte	1(25)	3(75)		
Protein intake	Fish	55(51.9)	51(48.1)		
	Chicken	12(37.5)	20(62.5)	2.82	0.141
	Beef/Goat	13(54.2)	11(45.8)	0.053	0.81
Vegetables intake	Cabbage/Lettuce	16(53.2)	14(46.7)	0.045	0.83
	Garden eggs	35(50.7)	34(49.3)	0.038	0.844
	Kontomire	41(48.2)	44(51.8)	0.21	0.649
	Others	3	1		
BMI	17 - 19.5	5(62.5)	3(37.5)	0.134	0.714
	19.6 – 24.5	27(49.1)	28(50.9)	0.03	0.849
	24.6 – 30.5	19(48.7)	20(51.3)	0.039	0.842
	30.6 – 35.5	4(50)	4(50)	0.134	0.713

There is no association between dietary factors such as carbohydrate intake, protein intake on prenatal anemia. (Table 4)

Bivariate analysis shows a positive association between being a case and having no formal education (OR-2.6, p-value 0.04), increased in birth spacing more than 5years (OR-3.06 p-value 0.029), herbal medicine intake (OR-3.61 p-value 0.007), parity of more than three children (OR-2.9, p-value 0.01). However ownership of ITN is protective against prenatal anemia. (OR 0.359, p-value 0.023).

Table 5: Multivariate Analysis

Variable	Crude OR	Adjusted OR	p-value
Parity 3 and more	2.9	1.59	0.37
No formal education	2.60	1.97	0.204
Increase years in birth spacing (5 years and more)	3.06	2.7	0.076
Herbal medicine intake	3.61	3.14	0.031
ITN Ownership	5.17	4.67	0.100

Multivariate analysis shows significant association between herbal medicine intake (OR-3.14, p-value 0.031) and prenatal anemia in Yilo Krobo Municipal.

4. Discussion

This study showed no formal maternal education as a risk to developing prenatal anemia (OR-2.6, p-value 0.041), educated women can read to acquire more information as well as follow medical instructions with understanding and make informed decisions concerning their health and pregnancy. Similar study conducted by Zhang Q et all in China [16] showed association between low educational status of mother and maternal anemia which agrees with the findings of this study. High maternal parity was identified as a risk factor to maternal anemia and this is possible if good nutrition and iron supplementation is not adhered to as maternal iron stores can easily be depleted as a result of previous child births. Birth spacing of 5years and more was identified as a risk factor for prenatal anemia from the bivariate analysis (OR-3.06, p-value 0.029) which is consistent with similar study by Razzaque A. [17] and his colleagues in Matlab, Bangladesh that found increasing anemia among women with birth spacing between 51-74months (OR>1). This study also showed increasing anemia among women with high parity (OR-1.78) and women with low educational status, (OR-1.0). The Matlab study found higher maternal morbidities following very long birth intervals and concluded that this may be a reflection of poor maternal health that prevented the woman from becoming pregnant for such a long time. Furthermore, the anemia found in long duration of birth spacing was also thought to be due to increasing maternal age. Women infected with malaria had a 5-fold higher risk of anemia than women without malaria. Malaria has also been reported as a primary cause of anemia in pregnancy elsewhere in Africa [18]. To effectively reduce anemia, at least 60% of pregnant women should sleep under ITN [1]. This study shows that ITN ownership is 87.3% and usage is high among the women without prenatal anemia compared to those having prenatal anemia. Ownership of ITN is protective against prenatal anemia. The usage of ITN by pregnant women prevent malaria infection which will lead to reduction in anemia in pregnancy.

Multivariate analysis shows significant association between maternal anemia and herbal medicine intake. Literature shows that herbal medicine use and their toxicity are related to genetic, age, concomitant condition and concurrent use of other drugs as well as the quality of the herbal preparation. Certain herbal remedies can reduce the efficacy of concurrent medicines, an example is co-administration of phenytoin with *'Shankhapashpi*

prepared from Centella asiatica, Convolvus pluricanlis, Nardostachys jatamanisi, Nepeta elliptica, Nepeta hindostoma and Onosma bracteatum was reported to result in reduced plasma concentration of pheneytoin leading to loss of seizure control [19]. It is possible that these intake of herbal medicines interact with prescribed hematinics reducing its bioavailability leading to anemia. A study conducted by E. Ernst and his colleagues [20] showed that herbal medicine usage in pregnancy in the following countries; Nigeria, South Africa and United States are 12%, 7% and 15% respectively. Among 242 pregnant women interviewed, 9.1% used herbal medicine and some of the documented side effects included miscarriage, high blood pressure in mother and baby, kidney failure, myocardial infarction in baby as well as mental retardation [20]. The finding of association between herbal medicine intake and anemia in Yilo Krobo municipal need further studies into these herbal products and their various effects.

5. Limitations

The first limitation of this study was the study design, using unmatched-case control study and the retrospective nature of case control studies together makes it difficult to make an exact cause and effect relationship between risk factors and prenatal anemia. Recall bias in relation to the type and frequency of food intake was seen as a limitation during data collection.

6. Recommendations

Health promotion and education should be targeted at pregnant women during the first trimester on proper nutrition and compliance to prescribed medications like fersolate and folic acid. Strategies and programs should be designed to educate families on the need to reduce their family size, minimize birth spacing of more than five years and prevent intake of herbal medications during pregnancy. Pregnant women in malaria endemic regions should use insecticide treated bed nets to minimize mosquito bites and reduce malaria infection which will subsequently lead to reduction in prenatal anemia.

There is a need for further studies into herbal medicine intake and prenatal anemia, to identify which particular herbal medicine is linked to anemia and the reasons behind it for policy formulation nationwide.

7. Conclusion

In conclusion prenatal anemia is a problem in Yilo Krobo municipal and associated risk factors are low maternal education, long duration of birth spacing, high parity and not owning ITN. Significant risk factor among these are herbal medicine intake during pregnancy and more studies into this is recommended.

Acknowledgement

I acknowledge the staff of Faculty of Public Health of Ghana College of Physicians and Surgeons, the Yilo Krobo Health Management team and all health facility in-charges in the Municipality for their support in carrying out this research.

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