DETERMINANTS OF ANAEMIA IN PREGNANCY IN SEKYERE WEST DISTRICT, GHANA

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SUMMARY
Anaemia associated with pregnancy is a serious health problem and its control requires the initial identification of the major factors responsible. Haemoglobin (Hb) levels of 205 women, aged 15 to 49 years, in the last trimester of pregnancy and residing within 4 of 6 sub-districts in Sekyere West district of the Ashanti region of Ghana, were determined. Demographic characteristics, dietary habits and other information were obtained and analysed. Blood and stool samples were tested for the presence of malaria parasites and intestinal worms respectively. The data showed that, 57.1% of pregnant women had Hb<10g/dl, the Ministry of Health cut off point for anaemia. Anaemia was more prevalent in rural compared to urban parts of the district (p=0.01). Low parity and young age were significantly associated with low Hb and high prevalence of maternal anaemia. Presence of malaria parasites in peripheral blood constituted a significant risk for low Hb (Hb = 9.2g/dL vs 9.5g/dL p=0.03). Independent of this, hookworm was even more strongly associated with low Hb (Hb = 8.3g/dL vs Hb=9.5g/dL, p=0.01). Contribution of dietary intake to the prevalence of anaemia cannot be inferred from the data generated under the current study.

Keywords: Anaemia, pregnancy, malaria, hookworm.

INTRODUCTION
Anaemia is an important public health problem worldwide and the most vulnerable group, are pregnant women and children. The causes of anaemia include genetic factors, nutritional deficiencies, and infectious agents[1]. Of the nutritional causes of anaemia, iron deficiency is probably the most common and important because the physiological changes associated with pregnancy exert a demand for additional iron needed for transfer to the foetus[2]. Infections, including malaria, hookworm and other helminths are also involved in the pathogenesis of anaemia in pregnancy. Pregnant women are particularly susceptible to malaria in endemic populations and often have higher prevalence as well as severity including anaemia[3]. The changes in the immune system associated with pregnancy have been suggested as the reason for this[4]. Hookworm infections on the other hand impair micronutrient absorption thus increasing the susceptibility of pregnant women to anaemia[5,6]. Recently, infection with HIV has emerged as an additional important risk factor for anaemia in pregnancy[7].

Most studies aimed at identifying the causes of anaemia in pregnancy have focused on specific categories of factors. The present study was designed to define anaemia in pregnancy in the Sekyere West district of the Ashanti region, located within the forest belt of Ghana, define the demographic characteristics of those at risk and identify the major causes in support of interventions to reduce anaemia within the district.

SUBJECTS AND METHODS
Study Area
The study was carried out in the Sekyere West district of the Ashanti region, within the forest belt of Ghana. The area has a wet season (February-October) and a dry season (November-January) with a mean annual rainfall of 81.1cm. The population of the district is 134,116 with 5365 expected pregnancies (2000 census) and antenatal coverage is 96.2%. It is an area of, hyperendemic transmission of malaria.

Study Subjects
Those recruited into the study were women in the last trimester of pregnancy aged 15-49 years old, of parity 0-10, from four sub-districts out of six,

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who reported for antenatal care (96.2% coverage gives a representative sample from health centres) at selected health centres over a two-month period, during the rainy season of the year 2000. The sample size was estimated based on anaemia prevalence of 67% (0.67)[8] with a margin of error of 0.0569. Two hundred and five (205) women were consecutively recruited after signed informed consent was obtained. The sub-districts included Mampong, location of the district hospital, Asubuasu, Kwamang and Nsuta. Subjects were grouped into urban and rural residency.

Detailed Interview

All pregnant women reporting for antenatal care at the selected heath centres during the study period who were eligible for recruiting after examination by the midwife were administered with structured questionnaire after signed informed consent was obtained. Data collected included antenatal care, infection, knowledge on anaemia, intake of iron-rich food and demography. No direct food consumption studies were, however, conducted.

Haemoglobin levels and parasitological examination

Blood was obtained from a finger prick and malaria parasitaemia determined by the microscopic examination of Giemsa-stained thick and thin blood films. Thick and thin smears were prepared on clean, dry microscope glass slides, and allowed to dry. The thin smears were fixed in methanol and both smears stained with 2% Giemsa (BDH Laboratory Supplies, Poole BH15 ITD, England). Asexual stages of *Plasmodium falciparum* were counted and the number of parasites/µl was calculated for each patient. Haemoglobin levels were determined by Sahli's method[10]. Stool samples were also examined for intestinal worms using standard methods. Briefly, a drop of an emulsion of stool was placed at each end of a microscope glass slide. Lugol's iodine was added to the drop for the determination of cysts. A cover slip was placed gently over drop and both preparations were examined under the light microscope[11]. Trophozoites and cysts of intestinal protozoa, ova and larvae of intestinal helminths, red blood cells and white blood cells were enumerated.

Date Analysis

The data was entered directly into EpiInfo version 6 and analysed with the same software, in addition to Excel, Sigma Plot and SPSS. Mean values were compared using parametric and non-parametric methods and a p-value of 0.05 was considered statistically significant.

Ethical Issues

The study was approved by the Sekyere West District Health Management Team (DHMT) and the School of Public Health's Scientific and Ethical Review Committee and informed consent was obtained from all study participants. All procedures followed were in accordance with the ethical standards of the Ghanaian Ministry of Health as well as the Helsinki Declaration of 1975[12].

RESULTS

Demography

One hundred and eleven 111 (54%) of the women resided in rural and 94 (46%) in urban areas. educational standards of the pregnant women was evenly distributed in rural and urban dwellers. Over 70% of the study subjects fell into age groups 20-24, 25-29 and 30-34 with teenagers (15-19) making up 7.8%. With respect to ethnic background, 148 (72.2%) of the respondents were Akans, indigenous to the study area whilst the remaining 27.8% belonged to other tribes (Ewe, Dagomba, Kokomba, Grushie, Kussasi).
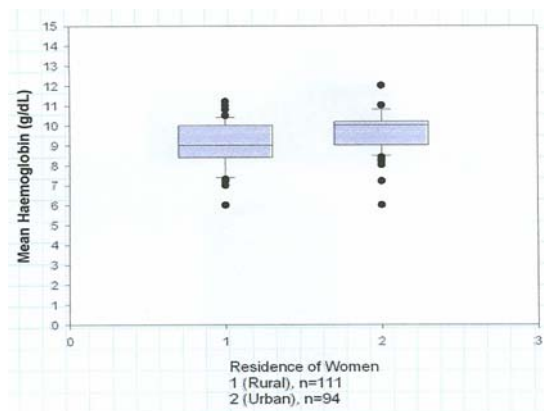
Anaemia in Pregnancy in Sekyere West District

The mean Hb level for the group of pregnant women (n=205) was 9.4g/dl. Using a cut-off point of 10g/dl[13], the frequency distribution of anaemia among the respondents for various parities and age groups is as shown in Table 1. One hundred and seventeen (57.1%) of the women were anaemic. Twenty-nine women (14.1%) had Hb<8.1g/dl, 75 (36.6%) fell between 8.1g/dl and 9.5g/dl. Only 2 women (1.0%) had Hb>11g/dl while two others (1.0%) were severely anaemic (Hb<7.0g/dl).

Table 1 Parity and age of women and the prevalence of anaemia (n=205)

Category	Frequency	Number Anaemic (Hb<10)
Age Group (years)		
15-19	17	13(76.5%)
20-34	159	92(57.9%)
35-49	29	12(41.4%)
Parity		
0	45	29(64.4%)
1	52	32(61.5%)
2-4	76	39(51.3%)
5-10	32	17(53.1%)

The rural communities (Asaam, Kofiase, Kwamang, Nsuta) had 72 (64%) anaemic women as compared with 45 (47.9%) of the women from urban areas (Mampong, Kwamang, Nsuta) that

were anaemic (p=0.001). The mean Hb levels were 9.1g/dl for rural residents and 9.7g/dl for urban residents (Figure 1)

Figure 1 Mean haemoglobin levels of pregnant women in rural and urban parts of the Sekyere west district, Ghana.

Demography and Anaemia
Lower prevalence of anaemia was significantly associated (r=0.86, p<0.001) with increasing age of the women. Similarly lower prevalence of anaemia was also strongly associated with increasing parity of the women (r=0.7, p=0.003) (Table 1). Other characteristics such as occupation of woman or husband, level of education, religious affiliation, ethnicity and marital status did not significantly affect the degree of anaemia in the Sekyere West district (Data not shown).

Eighty-one percent (81%) of respondents knew about anaemia either through a health worker or a neighbour and 51.2% knew the symptoms of anaemia and could identify some of the causes as well. Only 29 (14.1%) of respondents slept under bednets .

Dietary Intake
The basic diet comprised carbohydrates (cassava, plantain, yams, cocoyam and rice). One hundred and sixty-three (79.5%) of the respondents said that they ate three times in a day. One hundred and ninety-four (94.6%) of the women ate meat, fish and/or eggs everyday.

Thirty-two (15.6%) of the pregnant women said that they were culturally forbidden to eat certain foods during pregnancy, which include cocoyam, eggs, meat, sea-fish, pork and milk. One hundred and ninety five (95%) of the women took the prescribed haematinics (folic acid, vitamin B-complex and iron tablets) but only 51(25%) were on malaria

chemoprophylaxis and 29(14.1%) slept under the bednets or in a mosquito-proof room. There was no significant association between the number of times that respondents ate in a day, the nature of the diet and the prevalence of anaemia. The current study however, did not include dietary intake analysis such as recalls to collect data on actual foods and quantities consumed.

Effect of *falciparum* parasitaemia on mean haemoglobin levels
Malaria parasitaemia was present in 72(35.1%) pregnant women. Mean haemoglobin in women with malaria parasitaemia of any value but no hookworm was lower (9.2g/dL) than the value for women who were negative for malaria and hookworm (9.5g/dL), p=0.03 (Table 2).

Table 2 Mean haemoglobin levels in different categories of pregnant women

Mean haemoglobin levels for different categories (g/dl)			
P. falciparum Positive, hookworm negative n=144	*p. falciparum* negative, hookworm negative n=54	Hookworm Positive, *p.falciparum* negative n=7[1]	Hookworm Negative, *p.falciparum* negative n=79[1]
9.2*	9.5	8.3**	9.5

*Significantly lower than negative, p=0.03,
**Significantly lower than negative, p=0.01,
[1]Only a total of 86 out of the 205 pregnant women had their stool samples examined.

Presence of intestinal worms in stool and mean haemoglobin levels
Of the 86 pregnant women who provided stool for examination, only seven had hookworms. Mean Hb was 8.3g/dL in women who were hookworm positive but malaria negative, while those who were hookworm and malaria negative had a significantly higher mean Hb of 9.5g/dL (p=0.01) (Table 2).

DISCUSSION
The present study has shown that anaemia is prevalent in the last trimester of pregnancy among women in the Sekyere-west district of the Ashanti region of Ghana and significantly more prevalent in women in the rural areas as compared with the urban dwellers. The mean Hb for all the pregnant women in the last trimester in the present study was very low (9.4g/dl) compared to a mean value of 10.7g/dl for pregnant women in the immediate neighbouring district[14]. A total of 117 (57.1%) of the women were anaemic, Hb < 10 (p<0.01) and 2 were severely anaemic (Hb<7). This proportion of

women with anaemia is also much higher than reports from elsewhere in Africa[15,16].

The presence of malaria parasitaemia in the last trimester was identified as a major risk factor for maternal anaemia (Mean Hb = 9.2g/dL vs 9.5g/dL p=0.03). This is consistent with findings from elsewhere in Africa[16]. Malaria is hyperendemic in the study population, which is within the forest belt and is therefore a major cause of maternal anaemia in pregnancy. Our additional finding of a strong correlation between parity and prevalence of anaemia is also consistent with this fact since malaria in pregnancy occurs more frequently in the first few pregnancies[17]. Also in line with this, we found that prevalence of anaemia reduced significantly with increasing age of the woman, since older women are likely to have higher parity. The main complications of malaria during pregnancy are maternal anaemia and infant low birthweight[3]. One of the reasons given for the susceptibility of pregnant women to malaria is the ability of malaria parasites to sequester in the placenta, thus avoiding splenic clearance. The damage to the placenta by malaria parasites, results in induction of inflammatory responses, which cause thickening of the placental wall and a reduction of the flow of nutrients from the mother to the foetus, hence the low birthweight infants[17]. The other implication of this sequestration of malaria parasites in the placenta is that, there is a reservoir of parasites, which periodically enter the peripheral circulation and these parasites will cause destruction of erythrocytes during parasite schizogony, induce the elimination of uninfected erythrocytes by the reticuloendothelial system as well as cause suppression of bone marrow function[18,19,20]. Malaria control strategy, include the use of bednets[21] and accurate diagnosis of infection followed by prompt treatment with an effective antimalarial drug. Groups at risk such as the pregnant women in the present study are provided with chemoprophylaxis, but only a small proportion of them actually take any antimalarial or sleep under a bednet as shown by our data. In order to reduce the burden of malaria in these women and its impact on anaemia, it may be essential to establish a system of supervised intermittent presumptive treatment with a safe and effective antimalarial so as to eliminate any parasites they may harbour[7,22]. This will also help eliminate any asymptomatic parasitaemia capable of causing bone marrow suppression as has been reported[15].

Another significant cause of anaemia identified in the present study is the presence of hookworm and helminthes in the stool. An association was found between the presence of hookworm eggs in stool in the last trimester of pregnancy and low haemoglobin (Hb=8.3g/dL vs Hb=9.5g/dL, p=0.01). Studies in Kenya and Zanzibar also found an association between the presence of hookworm and anaemia in both children and adults and this was particularly significant in pregnant women[23]. Hookworms suck blood and cause bleeding which leads to blood loss, in addition to impaired nutrient absorption. Depending on the worm burden and nutritional status of the individual, the degree of anaemia can vary from mild to severe. Antihelminthic therapy will eliminate these parasites and reduce the level of anaemia among the pregnant women of the Sekyere West district.

The present study confirmed a significant association between rural dwelling and anaemia in pregnant women (p=0.01)[24]. One possible explanation is the higher prevalence of hookworm infestation in rural women compared to urban women, especially since the presence of hookworm alone in the stool was associated with a higher risk of low haemoglobin level in the last trimester compared to malaria parasitaemia alone. Malaria prevalence was not significantly different for the two communities, 36.9% for rural women and 31.9% for urban dwellers. Greater risk of development of severe anaemia has been reported in rural children compared to urban ones and this was ascribed to higher exposure to malaria in the rural areas compared to urban communities[25]. We did not observe any differences in malaria transmission between the rural and urban parts of the district. The major implication of this finding is that, rural women remain an important and a valid target group for measures to control anaemia in pregnancy.

Although infection with HIV has emerged as an additional risk factor for anaemia[26], we did not determine the HIV status of our study subjects and cannot comment on the role of HIV on the prevalence of anaemia in this particular study population.

In conclusion we have shown that anaemia in pregnancy is associated with malaria and hookworm infections and rural women appear to be at greater risk than urban dwellers in this part of Ghana.

ACKNOWLEDGEMENT

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