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Plasmodium Falciparum and Schistosoma Heamatobium Infections in Pregnant Women Attending Antenatal Clinic in Sekondi-Takoradi Metropolis Western Region Ghana

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Abstract

Plasmodium falciparum and Schistosoma hematobium infections are very common parasitic infections that affect pregnant women in the tropics. In this study we evaluated the prevalence and contribution to anemia of Plasmodium falciparum and Schistosoma heamatobium among pregnant women attending antenatal clinic in Sekondi Takoradi Metropolis.

This is across sectional study involving pregnant women attending antenatal clinic in Effia nkwanta regional hospital, Esikado hospital, Takoradi hospital and Jemima Crentsil hospital. Plasmodium falciparum detection and hemoglobin estimation were done from blood samples collected. Urine microscopy was done using the wet mount technique to detect the presence or absence of Schistosoma heamatobium

A total of 872 pregnant women were sampled, 23.4% (204/872)were infected with plasmodium falciparum infection, 3.3% (29/872) were infected with Schistosoma heamatobium infection and 34.2% (298/872) were anemic. Plasmodium falciparum infection had a significant association with anemia 32.2% (96/298)(P<0.001), Schistosoma heamatobium infection had no significant association with anemia, 4.4% (6/298) (p=0.3)

Plasmodium falciparum infection was higher and contributes more to anemia in pregnant women than Schistosoma heamatobium infection in this study. However it is very important to screen pregnant women for other parasitic diseases with lower prevalence than malaria to evaluate their burden and contribution to morbidity in pregnancy.

Introduction

Parasitic diseases constitute a significant portion of global infectious disease burden. Occurring worldwide but found mainly in tropical areas of the world and in sub-Sahara Africa where environmental and socio economic factors allow both vectors and pathogens to thrive facilitating spread of disease in the human population [1, 2].

P. falciparum is the deadliest of the *Plasmodium* species that cause severe forms of the disease in malaria endemic west Africa [3, 4]. In this region the risk of infection is higher for children and pregnant woman because of issues of rudimentary and altered immunity respectively [5, 6]. Pregnant women are particularly susceptible to infection during their first and second pregnancy on account of gravidity dependent immunity [7, 8]. Close to 10,000 pregnant women die from *P. falciparum* from over 25 million malaria infections yearly in sub-Sahara Africa [9, 10]. These infections carry grave consequences for both mother and child.

Schistosma heamtobium (SH) is a trematode that infects millions of people in Sub Sahara Africa[11, 12]. It causes urinaryschistosomiasis characterized frequently by hematuria and less frequently with dysuria [13]. Infection is gotten when infective cercaria penetrate the skin

of persons who come in contact with fresh water bodies like rivers, lakes and dams[14]. In many places in urban and rural settings in sub-Sahara Africa people use these water bodies as means of recreation like swimming, as a means of livelihood as in fishing and for domestic use as in washing of house old materials [15]. Children of school going age, women and men use these water bodies as a way of life.

In Ghana, pregnant women are exposed to both infections of *P.falciparum* and SH. Malaria in pregnancy is a serious public health issue constituting 28.1% of all OPD attendance. 13.1% of all admission and 9.1 of all maternal deaths [16]. SH in pregnant women on the other hand does not enjoy a robust statistical data like that of malaria, however some studies showed 4.5% prevalence in two districts in Ghana [17, 18]. The burden and prevalence of these infections varies in different regions and districts in Ghana. It is very important that more work be done in various regions and districts in Ghana to evaluate the burden of these two parasites in pregnant women. The objectives of this study was (1) to evaluate the prevalence of *plasmodium falciparum* and SH in pregnant women attending antenatal clinic (2) to evaluate the contribution of *plasmodium falciparum* and SH to anemia in pregnant women attending ANC in Sekondi Takoradi metropolis.

Methodology

Study site

This study was carried out in the Sekondi-Takoradi metropolis, Ghana. Sekondi-Takoradi, comprising the twin cities of Sekondiand Takoradi, is the administrative capital of the western region of Ghana with a land area of 385 km2. It is Ghana's fourth largest city and an industrial and commercial Centre with a population of about 335,000. The metropolis is an urban Centre surrounded by towns and villages. Temperatures are high with an average of 22 ◦C. It has a mean annual rainfall of 2.350 mm, which is experienced heavily in May and June with the minor rains occurring between September and October.

Study population and design

Pregnant women attending their antenatal care (ANC) visits were strategically sampled from four hospitals in the metropolis with the intention of recruiting pregnant women from sub-urban and rural communities of the city. These hospitals included Effia- Nkwanta Regional Hospital, Essikado Hospital, Takoradi Hospital and Jemima Crentsil Hospital. This cross-sectional study was carried out from the month of January to the month of October, 2010. Each facility was visited once every week on their routine antenatal days. Pregnant women, cross-checked with ultra-sound or with clinical evidence of pregnancy, were included in the study while pregnant women with significant bleeding were excluded from the study.

Questionnaire administration

Each consenting pregnant woman was asked of her demographic characteristics, education and occupational history, past and present obstetrics history. History of fever and any other illness during the pregnancy were asked.

Sample collection

About 5 ml of venous blood were collected from the pregnant women by a trained laboratory technician from the median cubitalvein. Blood samples were collected into an EDTA bottle and temporarily stored in an ice chest and were transported to a designated reference laboratory for same day analysis and storage. About 10 ml of urine was collected from the pregnant women in a clean container

Malaria diagnosis

Laboratory diagnosis of malaria was performed using fast RAPID response antibody kit (Premier Medical Corporation Ltd). The brand of the RAPID response kit was specific for the detection of *P.falciparum* antigens. The presence of two lines in the text kit well indicated

positive for *P. falciparum* malaria. The RAPID response kit contained a membrane strip pre-coated with monoclonal antibody specific for histidinerich protein 2 antigen of *P. falciparum.* For proper confirmation of malaria parasites, thick and thin smear with Geimsa staining were performed and examined microscopically using 100 power fields under oil immersion. Malaria parasites were counted against 200 leukocytes, read independently by two competent microscopists and where they had discordances, a third microscopist reassessed the slide. Malaria diagnosis was defined on the identification of any asexual blood stages of *P. falciparum* species in the thick and thin smears while a slide was pronounced negative when 100 high power fields have been examined using x100 oil immersion objective lens.

Urinary schistosomiasis diagnosis

SH detection was done using microscopy of urine sediments. About 10 ml of urine was collected from the pregnant women during their antenatal visits at the hospital or clinic premises. Urine samples were centrifuged and sediments examined under the microscope and eggs of SH counted directly. This was done by two microscopists and discordant results were resolved by a third microscopist.

Haemoglobin estimation

Haemoglobin estimation was performed using cyanmet hemoglobin method [19] Anaemia was defined based on WHO criteria haemoglobin levels of <11 g/dL[20].

Ethical clearance

Ethical clearance for the study was gotten from the Ghana Health Service Ethics Review Committee. Written informed consents were received from the recruited pregnant women.

Data analysis

Data and statistical analyses were performed using IBM SPSS Statistics version 17.0 (SPSS Inc., IL USA). Frequency distributions were done for all the characteristics of the pregnant women in the study (age, marital status, occupation, education, malaria and HIV status, anaemia, gravidity). These characteristics of the pregnant women were further analyzed using either Pearson χ^2 tests or Exact χ^2 test and ANOVA for the comparison of mean.95% confidence interval (CI) were used to measure the strength of the association and $P < 0.05$ was considered statistically significant.

Result

A total of eight hundred and seventy-two pregnant women were sampled for this study. Table 1 shows the characteristics of these pregnant women. 298 (34.2%) of the women were anaemic, 204 (23.4%) had *Plasmodium falciparum* infection while 29 (3.3%) had *Schistosoma heamatobium* infection. Majority of the women were married (93.1%), attended secondary school (61.4%) and were between the ages of 20-30s (60.6%).

Table 2stratifies the pregnant women based on their malaria status. There was no significant association (p=0.349) between the level of education and *Plasmodium* infection. There was also no significant association (p=0.9) between SH and *Plasmodium falciparum infection*. However age was significantly associated (P=0.02) with *Plasmodium* falciparum infection as the prevalence of *Plasmodium* infection was higher among pregnant women between the ages 13-19. Anemia also had a significant association (p<0.001) with *Plasmodiumfalciparum* infection.

Table 3 stratifies the pregnant women based on their SH infection status. There were no significant association seen between education and maternal anemia and age of the pregnant women with SH infection.

Table 4 stratifies the pregnant women based on their hemoglobin level. There was an association between anemia and *Plasmodium falciparum* infection as there was a significant difference (p<0.001) between *Plasmodium* prevalence among pregnant women with anemia

and pregnant women without anemia. There was no association noted between with SH and the hemoglobin levels of the pregnant women.

Discussion

Plasmodium falciparum and SH infections are common parasitic infection in sub-Sahara Africa. In this study we looked at their prevalence and their burden in contributing to anemia in pregnant women attending ANC in Sekondi-Takoradi metropolis.

In this study the prevalence of *P*. falciparum infection was very much higher than that of SH. Though both infections have same spatial distribution in endemic areas, SH have a more focal distribution and complex transmission cycle[21]. While *P.falciparum* requires female *Anopheles* mosquito as a vector for transmission to humans in the comfort of their homes, SH on the hand requires human-cercaria contact in a susceptible fresh water habitat. Sekondi-Takoradi is predominantly a coastal city with mainly salty sea water. However very few suburbs surrounding the metropolis have rivers that are potential source of SH infection. The paucity of appropriate fresh water bodies in the metropolis might explain the low prevalence of 3.3% compared to two other studies done in Bawku in the northern region and damaged district in Accra Ghana that both had a prevalence of 4.5% [17, 18].

P.falciparum infection was found to be associated with the age of the pregnant women as the prevalence was significantly higher in teenage pregnancy. This finding is in agreement with a study done in the northern part of Ghana 22]. Teenagers are basically still developing their immunity and hence with pregnancy there is a further depression of their immune system compared to their adult counterpart [23].

P. falciparum infection contributed more to anaemia than SH infection in this study. However, it is a well-established fact SH causes anemia and negative birth outcomes in pregnant women [17, 24, 25]. The insignificant contribution to anemia in this study might be due to the low prevalence of SH in this study. Despite the higher prevalence of *P. falciparum* in this study, it has been known to cause anemia in infected individuals especially in pregnant women and children [4, 26, 27].

Conclusion

While the prevalence of *P. falciparum* infection in pregnancy remains high in Sekondi-Takoradi just like all other parts of Ghana, that of SH infection is quite low, possibly due to the paucity of suitable fresh water habitats. Due to its low prevalence, SH infection contributes insignificantly to anaemia in pregnant women in the metropolis. Malaria, on the other hand, is still a big issue for pregnant women in Sekondi-Takoradi and other endemic areas, contributing greatly to anaemia. Notwithstanding, screening for other parasitic diseases to evaluate their burden and their contribution to morbidity in pregnant women is still very important

Table 1. General characteristics of pregnant women

Characteristics		**Frequency (n = 872)**	**Percentage (%)**
Age (Years)			
	15 – 19	107	12.4
	20 – 29	529	60.6
	30 – 29	221	25.4
	40 – 49	15	1.8
Marital Status			
	Married	812	93.1
	Single	60	6.9
Education			
	None	171	19.6
	Primary	128	14.7

	Secondary	535	61.4
	Tertiary	38	4.4
Occupation			
	Seamstress/Hairdresser	238	27.3
	Trader	367	42.1
	Farmer	132	15.1
	Food vendor	135	15.6
Malaria Status			
	Positive	204	23.4
	Negative	668	76.6
Haemoglobin			
	Anaemia	298	34.2
	Normal	574	65.8
S hematobium			
	Present	29	3.3
	Absent	843	96.7

Table 2. Characteristics of pregnant women stratified by malaria status

Characteristics		P – value	Malaria Positive (%)	Malaria Negative (%)
Education		0.349		
	None		45 (26.3)	126 (73.7)
	Primary		33 (25.9)	95 (74.2)
	Secondary		115 (21.4)	420 (78.5)
	Tertiary		6 (15.8)	32 (84.2)
Age of woman		0.02		
	<19 years (107)		37 (34.6)	70 (65.4)
	>20 years (765)		162 (21.2)	597 (78.0)
Maternal anaemia		<0.001		
	<11 g/dl		96 (32.2)	202 (67.8)
	>11 g/dl		108 (18.8)	465 (81.0)
S. hematobium		0.9		
	Present		6 (20.6)	23 (79.3)
	Absent		198 (23.5)	645 (76.5)

Table 3. Characteristics of pregnant women stratified by S.H status

Characteristics		P – value	S.H. Present (%)	S.H absent (%)
Education		0.57		
	None		4 (2.3)	167 (97.7)
	Primary		5 (3.9)	123 (96.1)
	Secondary		20(3.7)	515 (96.3)
	Tertiary		0 (0)	38 (100)
Age of woman		0.13		
	<19 years (107)		6 (5.6)	101 (94.39)
	>20 years (765)		23 (3.0)	742 (97.0)
Maternal anaemia		0.2		
	<11 g/dl		13 (4.4)	285 (95.6)
	>11 g/dl		16 (2.8)	558 (97.2)

Table 4: Baseline characteristics of the pregnant women stratified by haemoglobin level

Characteristics	Hemoglobin (<11 g/dL) (n = 298)	Haemoglobin (>11 g/dL) (n = 574)	P value
Education			
None	57 (19.9)	109 (19.7)	
Primary	43 (15)	77 (13.9)	0.11
Secondary	182 (63.4)	338 (61.1)	
Tertiary	5 (1.7)	29 (5.2)	
Occupation			
Farmer/trader	149 (96.8)	286 (94.7)	
Civil service	1 (0.6)	9 (3)	0.27
Teacher	4 (2.6)	7 (2.3)	
Malaria infection			
Negative	204 (68)	465 (81.3)	<0.001
Positive	96 (32)	107 (18.7)	
S hematobium			
Present	13 (4.4)	16 (2.8)	0.3
Absent	285 (95.6)	558 (97.2)	

List of abbreviations

SH: Schistosomaheamtobium
EDTA: Ethylenediaminetetraacetic acid
ANC: antenatal care
OPD: outpatient department

Declaration

Competing interest

Authors declare that they have no competing interest

Authors' contributions

ORISH Verner conceived, planned, executed the study and drafted the manuscript as well as analysis of data; Richmond Afoakwah, helped in drafting the manuscript; **Ekene Nwaefuna and Danny flint Yeboah** edited /reviewed and revised the manuscript. All authors have read and approved the final manuscript.

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