Helminthiasis in Pregnancy in the Niger - Delta Region of Nigeria

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ABSTRACT

BACKGROUND
Helminthic infestations during pregnancy have significant public health implications. This study seeks to determine the prevalence of intestinal helminths among pregnant women in the Niger Delta Region in Nigeria and to identify possible predisposing factors.

METHODS
Pregnant women attending antenatal clinics were randomly selected in 6 health facilities. Stool and blood samples were collected from each woman. The stool sample was examined for ova and cyst of parasites while blood samples were analyzed for eosinophil count and packed cell volume. Proforma designed for the purpose was used to obtain socio-demographic information. Students t-test was used to test relationship between variables with a p value <0.05 considered statistically significant.

RESULTS
The mean age of the patients was 27.9±5.2 years and the mean gestational age was 27.635±.4 weeks. The overall prevalence of helminthiasis in pregnancy was 91(22.7%), with Ascaris lumbricoides and hookworm being the most predominant at 9.7% and 8.2% respectively. The highest prevalence per health facility was in Emohua, a rural community with a prevalence of 48.5% and the least was at the University of Port Harcourt Teaching Hospital with a prevalence of 17.8%. There were significant association of helminthiasis with eosinophilia, anaemia, clay (nzu) eating, socioeconomic class, and source of water.

CONCLUSION
The prevalence of helminthiasis in pregnancy is high in the Niger delta region. It is associated with the lower socioeconomic class. Introduction of routine stool analysis and use of antihelminthic in pregnancy will help to reduce associated morbidity from intestinal helminth.

KEYWORDS
Helminthiasis; Pregnancy; Eosinophil Count; Anaemia; Nigeria.

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INTRODUCTION

The soil transmitted helminthiases are ancient diseases that continue to cause misery and disability in poor populations. The numbers affected are staggering. About 2 billion people harbour these infections worldwide, of which 300 million suffer associated severe morbidity[1]. Intestinal helminths are among the most common and widespread of human infections. They contribute to poor nutritional status, anaemia and impaired growth in children of school going age.[2]

Epidemiological surveys have revealed that poor sanitation and inappropriate environmental conditions coupled with indiscriminate defecation, geophagy and contamination of water bodies are the most important predisposing factors[3]. The prevalence and intensity of infection is especially high in the developing countries, particularly among populations with poor environmental sanitation[4]. Other practices such as hand washing, disposal of refuse, personal hygiene, wearing of shoes and others when not done properly may contribute to the infection or picking of these worms from the environment[2]. Tropical diseases such as malaria, intestinal helminths, schistosomiasis and filariasis have a dramatic impact on reproductive health. Many cases of unexplained pregnancy losses are due to undiagnosed tropical diseases.[1]

The most important cause of pathological chronic loss of blood and iron in the tropics is hookworm and other soil transmitted helminths[3] and malaria in pregnancy[2] The impact of intestinal helminth infections on anaemia during pregnancy is aggravated by low nutritional status of subjects whose staple food such as rice, cassava, and maize are poor sources of folate and iron[5,7] . Data on the epidemiology of iron deficiency anaemia in East Africa and elsewhere point to the important contribution of hookworms to this condition[5]. Maternal consequences of anaemia in pregnancy include substantial reduction in work capacity with difficulty in coping with household chores and child care[6].

The occurrence of helminth infection at high rates among pregnant women is mostly indicative of faecal pollution of soil and domestic water supply around homes due to poor sanitation and improper sewage disposal[4]. Most of these worms are transmitted through the soil whilst, the practice of soil-eating (geophagy) is common amongst pregnant women in many communities in developing countries[3]. Pregnant women are especially vulnerable to the harmful consequences of these parasitic infections due to increased nutritional demands during pregnancy.

Concerns about the safety of antihelminthic therapy in pregnancy have been expressed from time to time. Studies have contributed to the knowledge of consequences of using antihelminthic drugs to reduce morbidity during pregnancy. A systematic review aimed at determining the effect of antihelminthics in pregnancy on maternal, newborn and child health outcomes[8] showed that antihelminthics significantly decreased the prevalence of soil transmitted helminths infection. Three observational studies[1,2,4] showed that antihelminthics in pregnancy improved maternal iron status, while two other studies [7,8] reported beneficial effects on birth weight and infant survival. However it was reported that antihelminthics in pregnancy had no overall benefit on maternal anaemia, low birth weight and perinatal mortality[8]. Although few randomized controlled trials to date have failed to collectively demonstrate a clear beneficial impact of antihelminthics in pregnancy on maternal newborn and child health outcomes, findings from observational studies [4,8] suggest a potential benefit on maternal anaemia, birth weight and infant mortality. The World Health Organisation (WHO) recommends any of the following four drugs for the treatment of hookworm infection in pregnancy: Albendazole, levamisole, mebendazole or pyrantel[9]. These drugs administered after the first trimester, have been found to be safe and effective having few and minor if any, side effects[9].

There are hardly any studies highlighting the effect of intestinal helminths in pregnant subjects despite the fact that working and living in the Niger-Delta is fraught with many hazards of potential helminthic infections. Examples are, the high contamination of faecal matter with sources of drinking water, farming which is a predominant occupation in the upland Niger-Delta and fishing in fresh or salt-water environment while scavenging for sea-foods in the Niger Delta region.

This study was done to determine the prevalence of helminthiasis in pregnancy as well as assess the predisposing factors and also to evaluate the rationale for routine use of antihelminthics during pregnancy in the study area.

MATERIALS AND METHODS

Study Population

This study was a prospective cross-sectional study of pregnant women presenting at the booking clinic for antenatal care from May through July, 2014 at selected health institutions within the South-South geopolitical zone. All consenting women during the study period were recruited for participation in the study.

Study Sites

This study was done in selected health institutions ranging from primary to tertiary health care levels in the Niger delta. This was to evaluate women attending antenatal clinics who were expected to be of the various socioeconomic classes, to enable comparative analysis to be done on the prevalence of helminthiasis and its predisposing factors.

For the purpose of this study, a simple scoring system was used as a protocol for socio-economic classification as highlighted by Olusanya et. al[10]. This was based on the educational level of the patient and her husband's occupation.

Study Instrument

Designed proforma (Appendix I) was used to record demography information and clinical correlates for each participant, such as: age, educational status, occupation, husband's occupation, parity, gestational age, source of drinking water, residence, socioeconomic class, toilet facilities, use of clay etc.

Calculation of sample size

Sample size calculation was done using the formula for descriptive studies (Wingo et al, 1994)[11]

$n = p(1-p)Z^2/d^2$ where,

n- Sample size

p- Reported prevalence of helminthiasis among pregnant women (27.9%)[12]

Z- Z statistic for a two-sided comparison at 95% confidence level (1.96)

d- How close to the previous reported prevalence, the prevalence for the current study is desired to be (0.05)

Minimum sample size was thus calculated to be approximately 309 giving allowance for a 25% loss to follow up; the minimum sample size for the study was therefore 386 women.

Sampling Strategy

The sample size was distributed amongst the three tiers of health institutions based on distribution of pregnant women that attend antenatal care. This was determined by the proportion of deliveries in each health institution. The annual deliveries in 2008 include; UPTH 3285, Niger Delta University Teaching Hospital 383, General hospital Emohua 352, General Hospital Amassoma 280, Comprehensive health centre Aluu 328 and FSP health centre 259. The percentage contributed by each health facility to the total of 4887 was used to calculate the distribution of the participants. All pregnant women at the booking visit were recruited following informed consent. The recruitment was done by investigator with the help of a trained Research Assistant.

Inclusion criteria: All consenting pregnant women at booking.

Exclusion criteria: Those that refuse consent and those who have used antihelminithic in current pregnancy.

Sample Collection

Sample bottles for stool specimen were given to the pregnant women at booking and this was returned to the clinic the next day or at the next antenatal visit. Also 5mls of venous blood was collected from the antecubital vein of the recruited gravidae after consent had been obtained. This was done between the hours of 9 and 12 noon when clients come to book for antenatal care.

The stool samples were collected using wide-

mouthed bottles which were promptly sent to the UPTH laboratory and examined using the light microscope(saline or iodine-stained preparation). The various health facilities were within of 2 hours to UPTH. Smears were examined immediately for parasite ova and cyst. This procedure was supervised and analysed by a Consultant Medical Microbiologist.

About 5mls of blood was collected in an EDTA bottle and sent to the haematology laboratory for immediate processing. Capillary tube was inserted into the blood and its opposite end sealed with plastercine and subjected to microhaematocrit centrifugation for 30 minutes. After which packed cell volume (PCV) was determined using a haematocrit reader. A thin film was then made, fixed with methanol and stained with Leischmann solution and left to dry. It was then examined by light microscopy with a magnification of x100 for identification of eosinophil. The procedure was also supervised and analysed by a Consultant Haematologist.

Permission was sought from the departments of medical microbiology and haematology for use of their laboratory facilities.

Data Management

Data entry and analysis were done using SPSS 15.0 for windows® statistical software package. Statistical analysis of generated data was calculated using chi square students t-test. Fischer's exact test was employed as appropriate. Means, standard deviations and percentages are presented. Statistical significance was considered at $p < 0.05$.

Ethical Considerations

Ethical approval for this study was obtained from the ethical review board of the UPTH and administrative approval got from the participating hospitals. Written informed consent was also obtained from every eligible woman. The informed consent form is attached as appendix III. The following ethical issues were given due consideration during the period of the study; confidentiality, beneficence, non-malfeasance, right to withdraw.

RESULTS

Socio demographic characteristics

The mean age of the population was 27.89 ± 5.2 years. Twenty two (5.4%) of women were aged less than 20 years, 351 (86.5%) were in the age group 21-34 years, and 28 (6.9%) were greater than 35 years old. The mean gestational at booking was 27.63 ± 5.4 weeks. Majority (45.6%) of the studied population belong to socioeconomic class 1 and 43.4% belong to Class 2 and 3 while 21.7% and 1.5% belong to social class 4 and 5 respectively. Majority 87.9% of the women were married while 10.8 were not most of the women 74.1% were para 1-4 and nulliparous women were in the minority 4.9%, while grand multiparous women constituted 19.7% of the population.

Haematological evaluation showed that 43.9% of women had anaemia with haematocrit of less than 30%. The mean packed cell volume was 30.04% ± 3.2%. Eosinophilia was seen in 14% of the population.

Out of the 401 stool samples examined, 91(22.7%) were positive for intestinal helminth. The prevalence of 5 helminths found in their stool samples were; *Ascaris lumbricoides* 9.7%, hookworm 8.2%, Trichuris trichiura 2.2%, Enterobius vermicularis 1% and Strongyloides stercorales 1.5%. *A. lumbricoides* and hookworm infections accounted for majority 79% of all helminth infection recorded. The total prevalence of helminth infection per health facility were; 48.5% in General hospital Emohua; this was tested to be significant at p value of 0.001, 25.9% in Family support health centre Yenagoa ,25.8% in General hospital Amassoma, 21.9% in Comprehensive health centre Aluu, 17.9% in Niger delta University Teaching hospital, Yenagoa and 17.8% at the University of Port Harcourt teaching hospital, Port Harcourt. These are illustrated on Tables 3 and 4. Analysis was also made to compare the prevalence of intestinal helminthiasis with several risk factors.

Table 5 shows comparison between socioeconomic class in those women with or without helminthiasis. Majority of helminth infection occurred in the lower socioeconomic classes; 66.7% in class 5, 61.4% in class 3 and 58% in class 4. Whereas a minority of 4.6% occurred in class 1 and 6.7% in class 2 respectively. Classes 3-5 were statistically significant.

Table 6 compared the source of drinking water in women infected and those not infected with helminthiasis. Majority of infected pregnant women used sachet water-70% this was tested to be significant at p value of 0.002. Well water and stream water accounted for 48.3% and 50% respectively. These were also statistically significant at p value of 0.001 0.043 respectively. Whereas pipe borne water users accounted for 8.7% of infected cases and was insignificant at a p value of 0.271.

Table 7 compared the type of toilet facility used with presence or absence of helminthiasis. Majority of those infected used open field-55.6%, this was statistically significant at p value of 0.036. Stream- 45.5%, significant at p value of 0.034 and pit in 43.3% , significant at <0.001, while 12.6% of those who used water closet were infected. This was insignificant at p value of 0.634.

Table 8 compared clay(nzu) eaters with presence or absence of helminthic infection; 39.9% of clay eaters were positive for helminths and this was statistically significant at p value of 0.001 while 11.9% of non-clay eaters were positive. Among this figure A lumbricoides accounted for 53% amongst clay eaters.

Table 9 compared anaemia with presence or absence of helminthic infection; 44.1% of anaemic women were positive for helminths which was statistically significant, while only 5.8% of non anaemic women were positive. Hookworm accounted for 51.3% of the anaemic cases.

Table 10 compared eosinophilia with presence or absence of helminthiasis; 34.1% of those with helminthiasis had eosinophilia while in non-helminthic cases there was no eosinophilia.

Table 1: Socio-demographic characteristics of study population

	FREQUENCY (n)	PERCENTAGE (%)
AGE (years)		
⩽20	22	5.4
21- 34	351	86.5
⩾35	28	6.9
PARITY		
0	20	4.9
1-4	301	74.9
⩾5	80	19.7
SOCIO ECONOMIC CLASS		
1	185	45.6
2	15	3.7
3	88	21.7
4	88	21.7
5	6	1.5
MARITAL STATUS		
MARRIED	357	87.9
SINGLE	44	10.8

Table 2: Haematologic parameters of Study Population

Anaemia	Frequency (n)	Percentage (%)
Present	171	43.9
Absent	217	56.1
Eosinophilia		
Present	58	14.3
Absent	348	85.7

Table 3: Distribution of helminth in study population

Type of helminth	Frequency	Percentage (%)
A. lumbricoides	39	9.6
Hookworm	30	7.4
S. stercorales	24	5.8
T. trichiura	9	2.7
E. vermicularis	3	0.7
Mixed infection	3	0.6
None	297	73.2
Total	401	100

Table 4: Distribution of helminth per facility

Health Facility	Positive helminth	Negative helminth	Total	Percentage (%)	P value
Health centre Aluu	9	23	32	28.2	0.623
GenHosp. Amassoma	9	22	31	29	0.552
Gen. Hosp. Emohua	17	18	35	48.6	0.001
FSP Yenagoa	7	20	27	25.9	0.931
NDUTH	8	32	39	21.9	0.534
UPTH	42	194	236	17.8	0.171
	91	309	401		

Table 5: Distribution of stool parasite according to socioeconomic class

Class	Positive helminth	Negative helminth	total	Percentage(%)	P value
1	9	188	197	4.6	0.417
2	1	14	15	6.7	0.208
3	40	54	94	42.6	<0.001
4	37	51	88	42.1	<0.001
5	4	2	6	66.7	0.023
Total	91	309	401		

Table 6: Distribution of helminths according to source of drinking water

Source of water	Helminth present	Helminth absent	Percentage(%)	P value
Sacchet	7	3	70	0.002
Stream	5	5	50	0.043
Pipeborne	23	242	8.7	0.271
Well	56	60	48.3	0.001
Total	91	310	29.4	

Table 7: Distribution of helminths according to toilet facility

	Helminth present	Helminth absent	Percentage(%)	P value
Pit	42	55	43.3	0.001
Open field	5	4	55.6	0.036
Stream	5	6	45.5	0.034
Water closet	34	236	12.6	0.634
Total	91	310		

Table 8: Distribution of helminths according to clay(nzu) eaters

	Helminth present	Helminth absent	Percentage(%)	P value
Eat clay	63	95	39.9	0.001
Don't eat clay	29	215	11.9	0.911
Total	91	310		

Table 9: Distribution of helminths according to anaemia

	Helminth present	Helminth absent	Percentage(%)	P value
Anaemic	78	99	44.1	0.001
Not anaemic	13	211	5.8	0.614
Total	91	310		

Table10: Distribution of Helminth according to eosinophilia

	Helminth present	Helminth absent
Eosinophilia	31	0
No eosinophilia	60	310
	91	310

DISCUSSION

This study has demonstrated that the overall prevalence of helminthiasis in pregnant women in the Niger delta region is 22.7%, also higher prevalent rates of 48.5% and 25.9% were recorded in rural health facilities in the Niger delta region of Nigeria. This confirms a high prevalence and heavy intensity of helminthiasis in pregnancy in this region.

A high prevalence of these helminths have also been reported in other studies [13-14] In 2002, Ozumba[12] reported a prevalence of 27.9% and Fuseini et al[15] in rural Northern Ghana reported a prevalence of 41.2%.The prevalence rates of A. lumbricoides 9.72% and hookworm 8.22% in this study, were higher than those of other helminths, an observation that has been made in other studies in sub Saharan Africa.[16]

This study also highlighted the impact of socioeconomic class on helminth infection. Majority of the women with helminthic infection were from the lower class with concomitant poor hygiene practices and lack of pipeborne water. The lower socioeconomic classes of 3, 4 and 5 constituted 42.6%, 42.1% and 66.7% respectively of cases positive for helminthiasis in their respective classes, unlike the higher social classes of 1 and 2 which recorded 4.6% and 6.7% each. There was a statistical significant association between low socioeconomic class and helminthic

infection as reflected in their p values of less than 0.001 for classes 3 and 4, also class 5 had a p value of 0.028. This was unlike the higher classes of 1 and 2 whose p values were not significant. The relationship of income and helminthic infections has been observed in previous studies[17]. Low income predisposes to helminth infection[17].

In the earlier reported study in Ghana, the high prevalence of helminthiasis was indicative of poor sanitation and improper sewage disposal as majority of the participants had no toilet facilities in their homes. Similarly, this study conforms with the previous study as majority of the women with helminthiasis used open field - 55%, stream - 45.5% and pit 43.3%. These were all statistically significant. Majority of women infected used sachet water locally made under poor hygienic conditions, others used water from the stream and well where majority of them defecate with consequent contamination of their source of drinking water.

Geophagy (soil eating) is a type of pica, which involves the consumption of soil or clay, is common among pregnant women and children in sub-Saharan Africa[18]. In Ghana the high prevalence of helminthiasis was also attributed to the habit of clay eating[2,3]. In Kenya[4], majority of pregnant women ate soil regularly. In this study 39.9% of clay eaters had helminthiasis while only 9.9% did not have. This was also statistically significant. Among these women, *A lumbricoides* constituted 53% of all helminthic infection. The prevalence of geophagy in this study was 38.9% which is similar to earlier reported prevalence in pregnant women; 29% was reported in Tanzania[18]. Also *Ascaris lumbricoides* was commoner among these women, who are more at risk of Ascariasis due to its eggs that infected soil may contain.

In this study 44.1% of the population positive for intestinal helminth were anaemic, this was statistically significant at a p value <0.001. The most significant parasite associated with this risk was hookworm. This has been frequently reported in previous studies where the risk of anaemia was associated with Necator americanus, Ancylostoma duodenale, Trichiuris trichiuria, Strongyloides stercoralis and Enterobius vermicularis [18,19].

Antihelminthic therapy could be given to infected women before conception as a public health strategy to improve iron status. In addition, helminthiasis could be treated once diagnosed in the second or third trimester. In the current study, all women with helminthiasis in the second and third trimesters were treated with 500mg of mebendazole as ealier recommended.

Helminthiasis present in almost half of all women with anaemia indicates that there may be a rationale for routine use of antihelminths in women with anaemia. Antihelminths should however be combined with folate and iron supplementation. Torlesse[20] in 2001 evaluated the impact of a single dose of albendazole with iron folate supplementation. It showed an additive effect of iron folate supplementation along with antihelminths. This additive effect was however not observed by Larocque[21] in 2006 in which iron was also supplemented. The differences observed could be explained by the fact that whereas the Torlesse study was semisupervised, Larocque's study being an effectiveness study, the supplementation was unsupervised. Also the dose of iron was 36mg per day in Torlesse study and 60mg per day in Larocque 2006. According to the Institute of medicine, the tolerable upper limit for iron during pregnancy based on gastrointestinal side effects is 45mg per day (IOM 2001)[22]. So a higher dose in Larocque 2006 could have resulted in gastrointestinal side effects and hence non compliance of participants. Treatment with anti helminth earlier in the second trimester would improve food intake by relieving symptoms of anorexia caused by soil transmitted infections, reduced blood loss and also increased absorption of nutrients by reducing vomiting and diarrhoea associated with intestinal helminthiasis.

The strength of this study includes the relatively large sample size and the fact that hospitals from which the women were recruited included women of all socioeconomic classes- urban and rural settings.

Methodologic limitations: Include the use of one stool sample from each woman for determination of helminth with no concentration method used. This was due to difficulty in procuring ethyl/formal ether which may be used as a concentration method. It is however not routinely used at the UPTH laboratory and this may reduce the actual prevalence. A proportion of women with low intensity hookworm infection could have also been misclassified as uninfected. Hookworms shed eggs intermittently; therefore the prevalence of this infection is likely to be underestimated in this study if stool samples were taken at the time the eggs were not shed.

In conclusion, this study has shown the relatively high prevalence of intestinal helminths in pregnant women in the Niger delta region of Nigeria. This high prevalence has health implications in that, the infection could cause significant morbidity in pregnancy, especially anaemia and its sequelae. Routine stool analyses and antihelminthics should therefore be incorporated in the care of pregnant women during antenatal period.

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