Original Article

A Community-based Surveillance of Gastrointestinal Helminthiasis among Pregnant Women in Ibadan, South West Nigeria

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Abstract

Background: Intestinal helminthiasis is a major public health problem in Africa. Helminthic infection in pregnant women causes loss of appetite, poor nutrient absorption, gastrointestinal impairment, iron deficiency, and iron deficiency anemia resulting in low birth weights and preterm births. The main aim of this study is to assess the prevalence of helminthic infections in pregnant women in rural and peri-urban communities of Ibadan. **Materials and Methods:** A cross-sectional descriptive study was carried out at the antenatal clinics of 12 selected primary health centers and mission homes in Ibadan, Nigeria. Open- and closed-answer questionnaires were administered to 604 consenting pregnant women, who provided fresh stool samples for microscopy. Helminthic quantification was carried out by the Kato-Katz technique. Proportions were compared using Chi-squared with IBM® SPSS® Statistics 21 for analysis. Statistical significance was set at $P < 0.05$. **Results:** Eighty-nine stool samples (14.7%) were positive for helminthiasis. Most had roundworms (13.6%); 13 (2.2%) had hookworms. The mean arithmetic eggs per gram of feces were 2,124 and 248, respectively. No participant had a heavy intensity infection; nearly all were of low intensity. Participants ($P = 0.005$) and their husbands ($P = 0.005$) who had higher education were less likely to have helminthiasis. **Conclusion:** These communities are classified as Category III, having a low prevalence and low intensity infection. Therefore, prophylactic anti-helminthic treatment in pregnancy is not recommended. The inverse relationship with education may be a function of better living conditions. Better hygiene should be advocated.

Keywords: *Helminthiasis, Ibadan, Nigeria, pregnancy*

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Introduction

Intestinal helminthiasis is one of the major public health problems in Africa and Asia.[1] Poor sanitation and environmental conditions, indiscriminate defecation, contamination of water bodies, and geophagy are important predisposing factors responsible for persistent intestinal worm infections in these continents.[2] Inappropriate practices such as lack of hand washing, poor disposal of refuse, poor personal hygiene, as well as improper wearing of shoes also contribute to getting these worms from the environment and subsequent increased risk of infection.[3] Out of 20 major human helminth infections with public health importance,[4] the commonest are roundworms (*Ascaris lumbricoides*), hookworms (*Necator americanus* and *Ancylostoma duodenale*), and whipworm (*Trichuris trichiura*).[5] All these are known to be prevalent in African settings.[5]

Helminthic infection in pregnant women causes loss of appetite, poor nutrient absorption, gastrointestinal impairment, iron deficiency, and iron deficiency anemia resulting in low birth weights and preterm births.[6] Some intestinal helminths are also known

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to cause anemia by feeding on blood and through the release of some anticoagulants resulting in subsequent hemorrhage.[7] They also affect the supply of nutrients needed for hemopoiesis.[8] Hookworm and *T. trichiura* cause intestinal blood loss,[9] while *A. lumbricoides* interferes with the absorption of Vitamin A needed for blood formation.[10] Anorexia, vomiting, and diarrhea caused by these intestinal helminths may also reduce iron and other hematopoietic nutrients intake.[10] The subsequent iron deficiency anemia that results from all these has a negative effect on infants' cognitive function, physical growth, and development.[11,12]

The overall effect of helminthic infections particularly those due to hookworm on maternal morbidity and mortality, fetal well-being and outcome, as well as neonatal physical and neurological development led World Health Organization (WHO) to recommend the use of a prophylactic anti-helminthic after the first trimester, in communities where anemia is prevalent and hook worm infection is endemic (with a prevalence of 20–30%).[13] This use in pregnancy is safe, without risk to the fetus at this time.[10] A systematic review by Salam *et al*.[12] did not show sufficient evidence to recommend the use of anti-helminthics in pregnancy after the first trimester, although a single dose of anti-helminthics with iron and folate may have some beneficial effect on maternal anemia. More studies are needed to confirm these benefits. Also, there was no sufficient evidence for the outcome of use of anti-helminthics in pregnancy on low birth weight, perinatal mortality, and preterm birth.[12] This review was however based on only three randomized clinical trials.

Most previous studies on the prevalence of helminthic infections in Nigeria were hospital-based.[14-16] Hence this study aimed to evaluate the prevalence of helminthic infections and its associated factors in peri-urban communities of Ibadan through a community-based prospective cross-sectional survey.

Materials and Methods

Study design, area, and period

A cross-sectional study was conducted in Ibadan, South West Nigeria from February 2014 to March 2015. Ibadan is the capital of Oyo State, South West Nigeria and it is the third largest metropolitan city in Nigeria, with a population of 1,284,839.[17] It consists of urban, peri-urban, and rural areas. Peri-urban and rural communities of four local government areas (LGAs) – Ona-Ara, Lagelu, Ido, and Egbeda – were used for the study. These are the main peri-urban and rural LGAs in Ibadan. Primary health facilities which, in Nigeria, are the first-level health facilities closest to the people, as well as mission homes with significant antenatal attendance were randomly selected for the study. A mission home is a faith or traditional-based center, in which a traditional birth attendant supervises antenatal and delivery care. They are popular with residents of rural communities in Nigeria.

Study site selection

Mapping of all health facilities was carried out in all the four LGAs. Eight randomly selected primary health centers and four mission homes in the four LGAs were used for the study. Prophylactic anti-helminthics were not routinely prescribed at any of the study centers.

Study population

Pregnant women who presented to the selected primary health centers and mission homes were recruited into the study after giving a written consent. The sample size was estimated with a formula for cross-sectional studies, using an estimated prevalence of 16.3%.[16] The calculated minimum sample size was 210. Oversampling was done to account for attrition (participants' withdrawal) and to increase the power of the study.

Ethical issues

Ethical approval was obtained from the Oyo State Ethical Research Committee. Private places within the facilities were identified. Interviews were carried out confidentially either before or after the caregiver's antenatal examination. No intimate examination was performed. Results of the investigations were given to the participants at the next visit and all patients with helminths were treated with the recommended drugs once their pregnancies were beyond the first trimester. There was full confidentiality of all the clients' information and laboratory results.

Data collection technique

A pilot study (of the questionnaire arm of the study only) was carried out for 1 week at a primary health center in Idi-Ogungun. After the pilot phase, ambiguities and discrepancies in the questionnaire were corrected. At first contact, a universal specimen bottle was given to the pregnant women who gave consent to provide fresh stool samples on the morning of their next clinic visit day. A structured interviewers' administered questionnaire was administered by trained nursing personnel. The stool samples were transported within 1 or 2 hours to the medical microbiology laboratory in a teaching hospital where the stool analysis was carried out by a medical parasitologist.

Laboratory investigations

Kato-Katz technique[18] with cellophane fecal thick smear was used for the analysis and quantification of helminths. A small amount of fecal material was placed on the newspaper or scrap paper and a piece of nylon screen was pressed on top so that some of the feces sieved through the screen and accumulated on top. A flat-sided spatula was scraped across the upper surface of the screen to collect the sieved feces. A template was placed on the slide and the sieved feces were added with the spatula so that the hole in the template was completely filled. The spatula was passed over the filled template to remove excess feces from the edge of the hole. The template was removed carefully so that a cylinder of feces was left on the slide. The fecal material was covered with a pre-soaked cellophane strip.

The slide was placed on the fecal sample and was pressed firmly against the hydrophilic cellophane strip to spread evenly. The slide was placed on the bench with cellophane upwards to enable the evaporation of water while glycerol cleared the feces. For all helminths except hookworm eggs, the slide was kept for one or more hours at room temperature to clear the fecal material, prior to microscopic examination. The helminths were reported as eggs per gram (epg) of feces and the intensity of infection classified according to the WHO's recommendation.[19]

Data management and analysis

All filled questionnaires were crosschecked for consistency. Every item on the questionnaire was coded and a data template by the data manager was saved onto a computer. The data were dual entered using Epi-Data version 3.1. The hard copies of the data were kept confidentially, but available for future reference. After cleaning, the data were transferred to IBM® SPSS® Statistics 21 for analysis. Proportions were compared using Chi-squared test. Statistical significance was set at $P < 0.05$.

Results

Nine hundred and fifty women were recruited into the study; however, 604 (63.6%) submitted stool samples and were included into the analysis. The mean age of participants was 27.1 ± 5.7 years. Stool samples were taken at an average gestational age of 27.7 ± 7.3 weeks. None of the participants had used anti-helminthics during the course of pregnancy. Table 1 shows the demographic characteristics, including age group, marital status and marriage type, educational attainment, and occupation of participants and their husbands. Most participants were from the Yoruba tribe, which is the local tribe of the study area. Igede tribe, though not a major ethnic group, was singled out in this study, on account of their known occupation of farming in rural and peri-urban Ibadan. Table 2 shows obstetric characteristics of participants; these included their parity and the gestational ages at booking and stool sampling. Most participants were recruited in their third trimesters.

Eighty-nine stool samples were positive for helminthiasis, giving a prevalence of 14.7%. Table 3

Table 1: Demographic characteristics of participants assessed for helminthiasis between 2014 and 2015 in Ibadan, Nigeria

Variables	*n* (%)
Age (years)	
19 and less	32 (5.3)
20-24	198 (32.8)
25-29	171 (28.3)
30-34	126 (20.9)
35-39	56 (9.3)
40 and above	21 (3.5)
Ethnicity	
Yoruba	577 (96.2)
Igbo	12 (2.0)
Hausa	2 (0.3)
Igede	4 (0.7)
Others	5 (0.8)
Marital status	
Single	6 (1.0)
Married	598 (99.0)
Type of marriage	
Monogamy	520 (87.0)
Polygamy	78 (13.0)
Occupation	
Housewife	27 (4.5)
Student	17 (2.8)
Artisan/unskilled	432 (71.5)
Skilled	117 (19.4)
Professional	11 (1.8)
Husband's occupation	
Unemployed	3 (0.5)
Student	13 (2.2)
Artisan/unskilled	412 (68.2)
Skilled	132 (21.9)
Professional	44 (7.3)
Level of education	
None	9 (1.5)
Primary	76 (12.6)
Secondary	415 (68.7)
Tertiary	104 (17.2)
Husband's level of education	
None	7 (1.2)
Primary	37 (6.1)
Secondary	374 (61.9)
Tertiary	184 (30.6)

Table 2: Obstetric characteristics of antenatal clients assessed for helminthiasis in Ibadan, South West Nigeria

Variables	*n* (%)
GA at booking	
First trimester	117 (20.9)
Second trimester	346 (61.8)
Third trimester	97 (17.3)
Parity	
Primigravid	242 (40.1)
Primiparous	144 (23.8)
Multiparous	207 (34.3)
Grand multiparous	11 (1.8)
GA at stool sampling	
First trimester	29 (4.8)
Second trimester	230 (38.3)
Third trimester	342 (56.9)

GA=Gestational ages

Table 3: Types of helminths identified in the feces of antenatal clients in rural and peri-urban Ibadan, Nigeria

Type	*n* (%)
Ascaris lumbricoides	82 (13.6)
Necator americanus	11 (1.8)
Trichuris trichiura	2 (0.3)
Strongyloides stercoralis	2 (0.3)
Ancylostoma duodenale	2 (0.3)
Entamoeba histolytica	1 (0.2)
Any infection	89 (14.7)
Double infection	17 (2.8)

shows the distribution of the various worms identified, and indicated those that were infected with more than one type of infection. Most of them had roundworm infestation (Ascaris). Thirteen (2.2%) had hookworm infestation (Necator and Ancylostoma). Some women had two types of helminthic infection identified in their stool sample, but none had triple infection. Treatment was ensured for all women who tested positive for helminths. Table 4 shows the mean epg of feces for roundworm and hookworm, and the distribution of the intensity of infection. The average epg of feces for Ascaris was 2,123, while that of hookworm was 248. Most infections were of light intensity; none were of heavy intensity.

Table 5 shows a comparison between women who had gastrointestinal worms and those who did not. This was a comparison of characteristics previously depicted in other tables. Women who had tertiary education (P = 0.005) and those whose husbands had tertiary education (P = 0.002) were significantly less likely to have helminthiasis. Neither occupation nor tribe was significantly associated with helminthiasis.

Table 4: The mean egg counts of helminths and the intensity of helminthic infection in antenatal clients in rural and peri-urban Ibadan, Nigeria

	Ascaris lumbricoides	Hookworms	*Trichuris trichiura*
Arithmetic mean (epg)	2,123.7	248.0	-
Geometric mean (epg)	248.0	3.5	-
Light intensity infections (%)	74 (90.2)	13 (100.0)	2 (100.0)
Moderate infections (%)	8 (9.8)	-	-
Heavy intensity infections	-	-	-

Table 5: Comparison of the characteristics of antenatal clients in Ibadan, South West Nigeria who had helminthiasis with those who did not

Variables	Helminthiasis		χ^2	*P*
	Present	Absent		
Age (years)				
≤24	40 (17.4)	190 (82.6)	2.087	0.352
25-34	39 (13.1)	258 (86.9)		
≥35	10 (13.0)	67 (87.0)		
Ethnicity				
Yoruba	85 (14.7)	492 (85.3)	1.597	0.450†
Igede	1 (25.0)	3 (75.0)		
Others	3 (27.3)	8 (72.7)		
Marital status				
Single	0 (0.0)	6 (100.0)	0.599	0.383
Married	89 (14.9)	509 (85.1)		
Type of marriage				
Monogamy	75 (14.4)	445 (85.6)	0.397	0.254
Polygamy	14 (17.9)	64 (82.1)		
Occupation				
Unemployed*	4 (9.1)	40 (90.9)	1.368	0.505
Artisan/unskilled	67 (15.5)	365 (84.5)		
Skilled/professional	18 (14.1)	110 (85.9)		
Husband's occupation				
Unemployed*	3 (18.8)	13 (81.3)	5.143	0.076
Artisan/unskilled	69 (16.7)	343 (83.3)		
Skilled/professional	17 (9.2)	167 (90.8)		
Level of education				
Primary and below	19 (22.4)	66 (77.6)	10.736	0.005
Secondary	64 (15.4)	351 (84.6)		
Tertiary	6 (5.8)	98 (94.2)		
Husband's level of education				
Primary and below	13 (29.5)	31 (70.5)	12.358	0.002
Secondary	58 (15.5)	316 (84.5)		
Tertiary	17 (9.2)	167 (90.8)		
Parity				
Primigravida	34 (14.0)	208 (86.0)	0.727	0.395
Others	55 (15.2)	307 (84.8)		
GA at stool sampling				
First trimester	4 (13.8)	25 (86.2)	0.298	0.861
Second trimester	32 (13.9)	198 (86.1)		
Third trimester	53 (15.5)	289 (84.5)		

*Includes students; †Likelihood ratio statistics reported here.
GA=Gestational ages

Discussion

The study sought to assess the burden of helminthiasis in pregnancy in a rural/peri-urban population in Ibadan, South West Nigeria. The non-response rate of stool sample submission was relatively high. This may have been due to misgivings about sharing a stool sample, similar to what has been reported elsewhere.[20] It, however, does not take anything away from the study as the calculated minimum sample size of 210 was far superseded by the study population of 604.

Helminthiasis was not shown to be endemic in these communities, using the WHO cut-off of 20–30%.[13] This sub-endemic value corresponded to 16.3% found in South East Nigeria,[16] but was lower than 28% in another South East Nigerian study.[14] The former study[16] was carried out at various antenatal clinics (the level of healthcare delivery was not stated), while the latter[14] was in a tertiary teaching hospital. Our study is more likely to show a truer community picture than these, as it was carried out in primary healthcare and traditional homes. The prevalence was not influenced by anti-helminthic prophylaxis, as none of the participants had used any.

Most participants were unskilled workers. However, occupation was not associated with infestation, neither was tribe. Tertiary education of either the participant or her husband was the only significant protective factor identified of helminthic infestation; no pre-disposing factors were identified. It may be inferred that better educated people had better living conditions or may have practiced better hygiene than others.

Ascaris was the most prevalent of the helminthic infestations; hookworm occurred much less often. This is in variance with other studies in developing countries where hookworm infestation was relatively high.[16,21,22] A plausible reason may be that hookworm is soil-transmitted. Most of the index study's participants had secondary or tertiary education; there is less likelihood that they would engage the terrain barefooted (e.g., as farmers or casual workers). Ascaris infection formed a light intensity infection, as did the other helminths. The community was therefore classified as Category III, that is, it has a low prevalence (<50%) and a low intensity (<10% heavy intensity).[19] The recommendation for Category III is case treatment, rather than population treatment; hence all women who tested positive were treated. Light intensity infection of hookworm translates to a blood loss of less than 2 mg of hemoglobin per gram of feces.[19] This means that hookworm was not a significant contributor to anemia in this community.

Where screening programs are required, they are inexpensive (its current local cost is less than a dollar per patient) and tests can be carried out relatively quickly, such that the patients can be treated the same day. This is preferred to being treated at a later date, at which time, the morbidity may have worsened.

Limitation

The limitation of the study was that information on occupation was not specific, as farming was not singled out, but was coded as "unskilled/artisans." This did not allow specific comparison of farmers with the other participants. The Igede tribe members were recorded, as they are known for their farming occupation; however, their numbers were too small to draw any conclusions from. This limitation may not be significant due to the low proportion of geohelminths found in this study.

Conclusion and Recommendation

Gastrointestinal helminthiasis is not endemic in the study area. Despite this, it is apparent that formal education should continue to be encouraged, as its implications are enormous. The general role of hygiene in preventing communicable diseases, including helminthic infection, in pregnant mothers should be advocated.

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Conflicts of interest

There are no conflicts of interest.

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