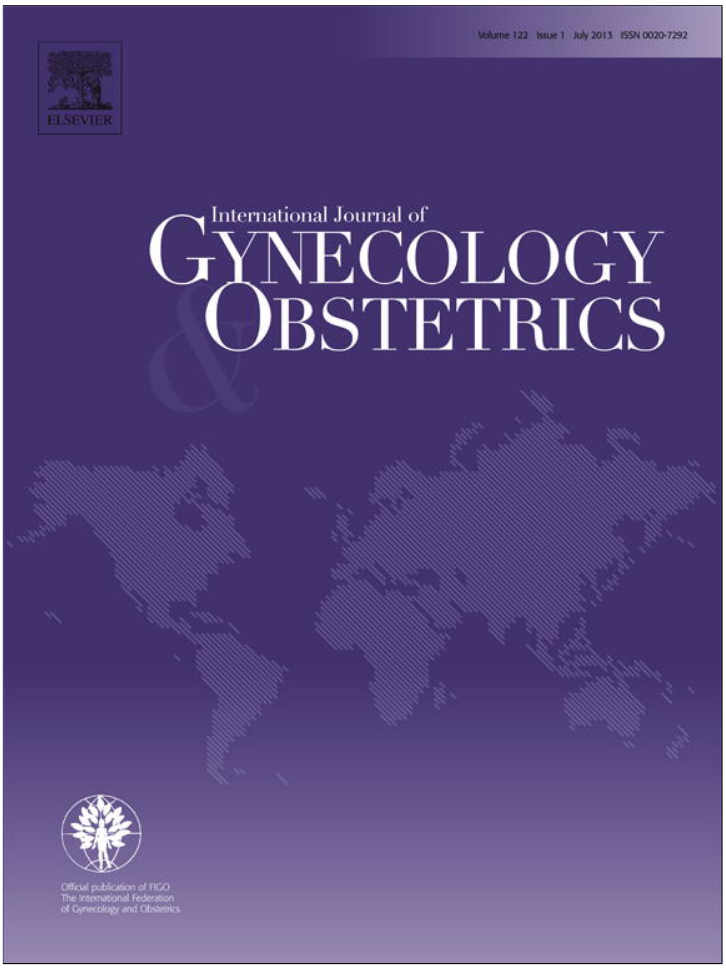

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CLINICAL ARTICLE

Schistosomiasis among pregnant women in rural communities in Nigeria

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ABSTRACT

Objective: To assess the epidemiology of urogenital schistosomiasis among pregnant women in rural communities of southwestern Nigeria. *Methods:* The present cross-sectional epidemiologic survey of urogenital schistosomiasis was conducted during 2010–2011 among pregnant women in Yewa North Local Government, Ogun State, Nigeria. The women were microscopically screened for infection with *Schistosoma haematobium*. *Results:* Of 313 volunteer participants, 20.8% tested positive for *S. haematobium* infection. The prevalence of infection was highest (31.5%) among women aged 20–24 years. The infection intensity did not differ significantly between age groups ($t = 1.848$, $P = 0.71$). Primigravidae and women in the first trimester of pregnancy had the highest intensity of infection with 33.1 and 27.7 eggs/10 mL of urine, respectively. There was an association between disease prevalence and parasite intensity across the age groups ($\chi^2 = 68.82$, $P = 0.02$). The prevalence of *S. haematobium* was not associated with age or pregnancy trimester ($P = 0.06$), but associations existed between intensity of infection and gravidity ($P = 0.001$). *Conclusion:* The prevalence of urogenital schistosomiasis among pregnant women in Nigeria was high, with younger women and primigravidae at the greatest risk. These data can be used to develop a schistosomiasis control program among pregnant women in the study area.

1. Introduction

Schistosomiasis is a poverty-associated disease with serious health consequences that is prevalent in many parts of Sub-Saharan Africa [1]. In the tropical regions, approximately 207 million people are estimated to have the disease, with approximately one-tenth experiencing severe illness [2]. Studies conducted in Sub-Saharan Africa [3] indicate that more than half of all infected individuals experience substantial morbidity. In Nigeria in the 1990s, 25 million people were infected, 101 million were in danger of being infected, and approximately 30 million would need treatment annually for the disease [4]. Human contact with water and the presence of a certain type of water snail that serves as intermediate host are the factors responsible for transmission.

Unlike with school children, where abundant data on schistosomiasis are available, little is known about schistosomiasis among pregnant women in Nigeria; hence, the prevalence of the disease among pregnant and lactating women in Nigeria is uncertain. A WHO report of the disease in Africa revealed that 10 million pregnant women were infected in 2002 [5]. In nonpregnant populations, schistosomiasis may produce nutritional and hematologic impairments, leading to an increased risk of mortality [6]. However, although a large number of pregnant women live in endemic areas and are at risk of infection, there is paucity of data on maternal and neonatal schistosome-associated morbidities [7].

Most schistosomiasis treatment programs in Nigeria use school-based resources and target the younger age groups, which carry the greatest burden of infections. Older groups, including pregnant women, are often left untreated. Morbidity therefore builds up among untreated pregnant women and may result in poor pregnancy outcomes such as low birth weight, and maternal and infant mortality [7]. Animal models have also shown possible links between maternal and congenital schistosomiasis [8,9]. However, despite evidence of schistosomiasis-associated morbidity among pregnant women, the ministries of health of many endemic countries have failed to endorse praziquantel administration to this population [5]. Increased morbidity owing to infection is therefore inevitable among pregnant women.

Knowledge of the size of the *Schistosoma*-infected pregnant population is important in planning infection control interventions [10]. Although schistosomiasis has been reported among pregnant women in some African countries [10,11], there have been no such reports in Nigeria. The present study was conducted with the aim of drawing attention to the occurrence of schistosomiasis among pregnant women in endemic communities in Nigeria, and to provide the baseline data necessary for future control of the disease in the study population.

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2. Materials and methods

The present cross-sectional and descriptive study—conducted between February 1, 2010, and February 15, 2011—was approved by the Joint Ethics Review Committee of the University of Ibadan and the University College Hospital in Ibadan, Nigeria. The study was carried out in Yewa North Local Government Area (LGA), which has the largest land area in Ogun State, Nigeria, and is located in a deciduous/derived savannah zone [12]. The population size in 2005 was 232 236. The endemicity of schistosomiasis in Yewa North LGA is attributable to a lack of good water sources, forcing community dwellers to depend on river water for their domestic use. The LGA includes many river bodies where the snail that serves as intermediate host of infection has been observed [13]. In the past, there have been mass drug administrations to children for the control of *Schistosoma haematobium*, without due consideration for pregnant women. No organized treatment program was in place at the time of the present study.

The LGA was divided into 10 wards (Table 1). Each ward had at least 1 primary health center with a prenatal clinic that was run by the local government. If a ward had several such clinics, the participants were recruited from the clinic with the highest attendance. All pregnant women who gave written informed consent were included, irrespective of their religion, occupation, socio-economic status, and others factors that could have created bias in the study. Visitors or women not residing in the study area were excluded from the study.

The sample size was determined as described by Daniel [14]. Given the absence of data on the prevalence of urogenital schistosomiasis among pregnant women in Nigeria, a preliminary pilot study was carried out among 30 pregnant women randomly selected from some of the wards. In this pilot study, the proportion infected was 30%. This figure was used to calculate a minimum sample size of 223, assuming a precision of 0.05 (5%) [15] and a statistical power of 80%.

The participants received pre-labeled universal bottles for urine collection. The urine samples—collected between 10 and 14 o'clock—were examined within 3 hours of collection by trained personnel in the Parasitology Research Unit Laboratory of the Department of Zoology, University of Ibadan. Each sample was mixed well and 10 mL was subjected to centrifugation at 5000 rpm for 5 minutes. After removal of the supernatant, the sediments were viewed under a light microscope to determine the presence of terminally spined *S. haematobium* eggs. The intensity of infection was categorized as light if the egg count was smaller than 50 eggs/10 mL of urine, and heavy if the egg count exceeded 50 eggs/10 mL of urine [16].

Each participant completed a structured questionnaire during a prenatal consultation. The following information was gathered: age, trimester, gravidity, and water contact pattern, with these recorded against the participants' recruitment numbers. The questionnaires were administered by trained individuals in Yoruba (spoken by the majority of the participants) and was translated for speakers of other languages such as Igbo and Hausa.

The data were analyzed using SPSS version 17.0 (IBM, Armonk, NY, USA). The statistical significance of differences in the intensity of infection was determined via *t* test. Differences in prevalence were tested by the χ^2 test. Contingency χ^2 analysis was used to determine the association between prevalence and intensity of infection. Univariate and multivariate analyses were also conducted, with *S. haematobium* infection as the dependent variable and age, gravidity, trimester, ward, and water contact pattern as independent variables. $P < 0.05$ was considered statistically significant. There was no correction for multiple testing.

3. Results

In total, 313 pregnant women (mean age 26.2 ± 5.6 years, range 15–42 years) were examined for infection with *S. haematobium*. Of these, 65 (20.8%) tested positive for *S. haematobium* infection. The prevalence and intensity of infection were associated ($\chi^2 = 68.82$, degree of freedom [df] = 5, $P = 0.02$).

Ijoun had highest prevalence of schistosomiasis (42.2%), whereas the infection intensity was highest in Ebute (32.2 eggs/10 mL of urine) (Table 1). The prevalence and intensity of infection varied significantly between the wards ($\chi^2 = 28.57$, df = 7, $P = 0.001$). Univariate analysis showed that age, trimester, gravidity, and water contact pattern of the pregnant women also varied significantly between the wards ($P < 0.05$).

The prevalence of infection was higher among lower age groups (with slight deviation in women aged 15–19 years) than older age groups, with the highest prevalence (31.5%) recorded among women aged 20–24 years (Table 2). The intensity of infection, however, showed no age-related pattern.

The prevalence of urogenital schistosomiasis did not vary significantly by pregnancy trimester ($P = 0.75$), with women in the first trimester having the highest prevalence (33.3%) and intensity of infection (27.7 eggs/10 mL of urine) (Table 2). The intensity of infection decreased with increasing pregnancy duration. The combined effect of trimester and water contact pattern was significantly associated with the prevalence of *S. haematobium* infection ($P = 0.04$).

The prevalence of infection by gravidity followed a declining pattern, with primigravidae having the highest prevalence (25.7%) (Table 2). The infection intensity varied significantly by gravidity ($P = 0.001$) and was also highest among primigravidae (Table 2). The difference in infection intensity between secundigravidae and multigravidae was not significant ($t = 7.903$, df = 1, $P = 0.08$).

The proportion of women who depended solely on river water for their water supply was lowest in Imasai (0.0%), Sunwa (6.3%) and Ayetoro (8.7%) and highest in Ijoun (52.2%) and Eggua (52.9%) (Table 3). Ayetoro and Imasai had the highest proportions (58.7% and 50.0%, respectively) of pregnant women who used other sources of water (well, borehole, and pipe-borne water) only. The proportions of pregnant women who used river water combined with other sources

Table 1
Community-level prevalence of urogenital schistosomiasis among pregnant women.

Ward (Community)	Total examined	No. infected	Prevalence, %	GMI[a]	OR (95% CI)
Ebute (Oja Odan)	16	5	31.3	32.2	2.23 (1.87–2.58)
Sunwa (Sawonjo)	24	2	8.3	6.9	1.95 (1.63–2.27)
Imasai (Imasai)	11	1	9.1	17.0	2.50 (2.09–2.90)
Ayetoro (Ayetoro)[b]	152	22	14.5	13.2	2.44 (2.31–2.58)
Ijoun (Ijoun)	45	19	42.2	15.6	1.53 (1.26–1.80)
Igbogila (Igbogila)	32	7	21.9	21.8	2.21 (1.97–2.24)
Eggua (Eggua, Igan Alade)	17	7	41.2	12.5	1.28 (0.95–1.62)
Joga/Iboro (Ijoga Orile, Iboro)	16	2	12.5	23.7	1.96 (1.04–2.87)
Total	313	65	20.8	16.5	2.01 (1.64–2.39)

Abbreviations: CI, confidence interval; GMI, geometric mean intensity; OR, odds ratio.
[a] Number of eggs in 10 mL of urine.
[b] Three wards.

Table 2
Univariate and multivariate analyses of factors associated with *Schistosoma haematobium* infection.

Characteristic	Number examined	Number infected	Prevalence, %	GMI[a]	OR (95% CI)
Age, y					
15–19	30	4	13.3	16.8	0.52 (0.81–0.56)
20–24	89	28	31.5	23.6	2.32 (1.97–2.74)
25–29	87	15	17.2	13.8	0.73 (0.38–1.39)
≥30	107	18	16.8	27.9	0.64 (0.35–1.18)
Total	313	65	20.8	21.1	1.05 (0.88–1.47)
Univariate (*P* value)	–	–	0.32	0.71	–
Multivariate (*P* value)					
Age + trimester	–	–	0.69	0.93	–
Age + gravidity	–	–	0.90	0.84	–
Age + ward	–	–	0.13	0.99	–
Trimester					
First	6	2	33.3	27.7	1.69 (0.30–9.48)
Second	79	16	20.3	22.0	0.80 (0.42–1.53)
Third	193	46	23.8	14.6	0.86 (0.47–1.58)
Total	278	64	23.0	20.7	1.12 (0.40–4.20)
Univariate (*P* value)	–	–	0.75	0.06	–
Multivariate (*P* value)					
Trimester + gravidity	–	–	0.04	0.03	–
Trimester + ward	–	–	0.99	0.001	–
Trimester + water contact pattern	–	–	0.04	0.001	–
Gravidity					
Primigravidae	105	27	25.7	33.1	1.51 (0.86–2.67)
Secundigravidae	66	14	21.2	10.7	0.99 (0.50–1.97)
Multigravidae	142	24	16.9	13.8	0.68 (0.39–1.20)
Total	313	65	20.8	17.0	1.06 (0.58–1.95)
Univariate (*P* value)	–	–	0.32	0.001	–
Multivariate (*P* value)					
Gravidity + ward	–	–	0.46	0.001	–
Gravidity + water contact pattern	–	–	0.69	0.001	–

Abbreviations: CI, confidence interval; GMI, geometric mean intensity; OR, odds ratio.
[a] Number of eggs in 10 mL of urine.

of water supply were highest in Sunwa (68.8%) and Igbogila (55.2%) (Table 3). The proportions of women using river water only, river water and other sources of water, and other water sources only differed significantly in Ijoun and Eggua ($P < 0.05$). In the other wards, similar proportions of women used the 3 different water source categories ($P = 0.20$) (Table 3). There was also no association between water use pattern and age ($P = 0.72$).

4. Discussion

Epidemiologic data on schistosomiasis among pregnant women in Nigeria have been sparse. The 20.8% prevalence rate reported in the present study is lower than previously reported values among other population groups [17,18]. This could be explained by the tendency in this part of the world to place restrictions on pregnant women to pursue activities such as visiting natural water sources. The high prevalence of infection observed in Ijoun and Eggua can be explained by a lack of potable water supply in these wards; as a result people are forced to source for water from river bodies, which could serve as foci of schistosome transmission. By contrast, the Sunwa and Imasai communities have a relatively good water supply, which is reflected in the lower level of infection. There was also a significant association between prevalence and intensity of infection across the wards. The reason could be that people in highly endemic communities tend to spend more time in water than people in lower endemic areas, resulting in a higher worm burden. The results are not biased by the fact that the study only included pregnant women who attended prenatal care because the charges for prenatal care in rural primary health centers in Nigeria tend to be low, thus encouraging women of all socio-economic backgrounds to attend prenatal clinics.

Table 3
Pattern of water use among pregnant women in Yewa North Local Government, Ogun State, Nigeria (n = 202).[a]

Ward	Total contacts	River water only	River water + other sources[b]	Other sources only[b]	*P* value
Ebute	13	6 (46.2)	6 (46.2)	1 (7.7)	0.23
Sunwa	16	1 (6.3)	11 (68.8)	4 (25.0)	0.23
Imasai	12	0 (0.0)	6 (50.0)	6 (50.0)	0.34
Ayetoro[c]	92	8 (8.7)	30 (32.6)	54 (58.7)	0.27
Ijoun	23	12 (52.2)	9 (39.1)	2 (8.7)	0.02
Igbogila	29	4 (13.8)	16 (55.2)	9 (31.0)	0.91
Eggua	17	9 (52.9)	6 (35.3)	2 (11.8)	0.001

[a] Values are given number (percentage) unless otherwise indicated.
[b] Other sources consisted of well, borehole, and pipe-borne water.
[c] Three wards.

The present study showed that *S. haematobium* infection does indeed occur among pregnant women. This finding contradicts the common proposition that pregnant women are not sufficiently exposed to transmission foci of the parasite. Previous studies of the prevalence of schistosomiasis during pregnancy include the works of Muhangi et al. [19] in Uganda reporting a prevalence of 18.3%, Ajanga et al. [11] in Tanzania reporting a prevalence of 63.5%, and Khalid et al. [10] in Sudan reporting a prevalence of 13.0%. In the present study, pregnancy trimester and gravidity were not associated with the prevalence of schistosomiasis. However, younger women were at a higher risk of *S. haematobium* infection, which is in agreement with a previous report [11].

The infection intensity decreased with each trimester of pregnancy. This decrease was particularly marked during the third trimester. During pregnancy, when increasing levels of estrogens and progesterones are produced to allow fetal development, the susceptibility to parasitic infection is often increased [20,21]. As a result, women in the third trimester would be expected to be at the highest risk, given their increased levels of reproductive hormones and corticosteroids. The present results clearly contradict this assumption because women in the earlier trimesters had a higher disease burden. Women in rural settings in Nigeria often delay their prenatal consultations until late pregnancy, so the high number of third-trimester

women (recruited at baseline) with probably low disease burden could have led to this disparity. The physiologic changes during pregnancy can result in frequent micturition, especially in late pregnancy. This could have an effect on the intensity of infection in the third trimester because the majority of parasite eggs might have been excreted during urinations prior to the urine sample, resulting in a reduced total egg count.

The prevalence and intensity of infection in the present study decreased with an increasing number of previous pregnancies. This is in accordance with other diseases such as malaria [22,23]. As a result, the morbidity associated with schistosomiasis might be more pronounced among primigravidae.

The present study might not have detected the true prevalence of schistosomiasis among pregnant women because a single urine sample was used for the analysis. Multiple examinations might have revealed a slightly higher prevalence.

In conclusion, the level of *S. haematobium* infection among pregnant women was high, especially among younger women and primigravidae. The administration of praziquantel is considered safe and without adverse effects in late pregnancy. Therefore, management of schistosomiasis with chemotherapy could be of immense benefit in endemic areas. An effective way of achieving this would be the routine introduction of treatment at prenatal clinics. This would help to abate the associated morbidity effects of infection on pregnant women and their developing fetuses.

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Conflict of interest

The authors have no conflicts of interest.

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