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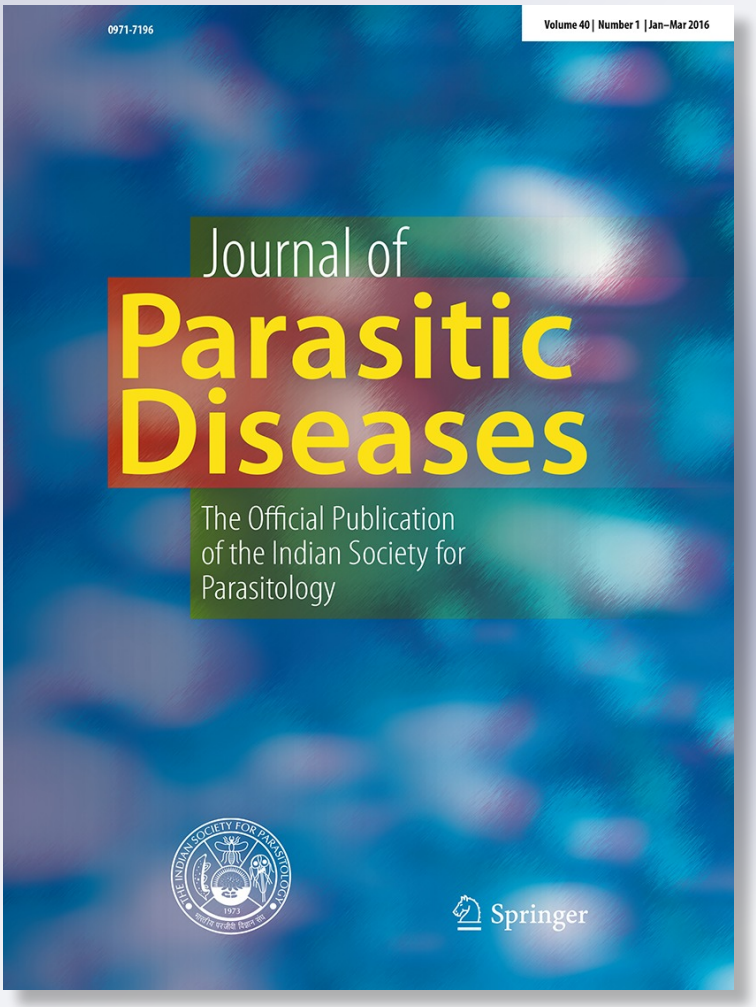
Journal of Parasitic Diseases

ISSN 0971-7196
Volume 40
Number 1

J Parasit Dis (2016) 40:93-99
DOI 10.1007/s12639-014-0454-2



Springer

J Parasit Dis (Jan-Mar 2016) 40(1):93–99
DOI 10.1007/s12639-014-0454-2

ORIGINAL ARTICLE

Schistosomiasis transmission; socio-demographic, knowledge and practices as transmission risk factors in pregnant women

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Received: 18 November 2013 / Accepted: 20 March 2014 / Published online: 18 April 2014

Abstract *Schistosoma* transmission is influenced by the interplay between various factors ranging from parasite to host associated factors. While many studies have focused on mass chemotherapy to reduce transmission in other populations, no study has examined the impact of social factors that favour transmission in pregnant women in Nigeria. The study was conducted to assess the impact of knowledge, attitudes and sociodemographic factors on schistosomiasis burden in pregnant women of rural communities of Nigeria. A cross sectional community-based field study was conducted to assess the association between *Schistosoma haematobium* burden and the associated risk factors among pregnant women in rural endemic communities of Nigeria. Structured questionnaire was used to gather information on participants' socio-demographic data, knowledge on schistosomiasis and water contact activities. Of the 237 respondents examined microscopically for infection, 50 (21.1 %) were infected with overall mean infection intensity of 69.6 ± 165.2 eggs/10 mL urine. Multivariate logistic analysis showed occupation of the women to be associated with infection with the artisans having the highest risk (OR 3.34, CI 1.67–6.69, $P = 0.022$). Contact with water and water usage patterns are also associated with prevalence of disease with fetching (OR 2.04, CI 0.19–3.51, $P = 0.003$) and multipurpose water usage (OR 4.31, CI 2.17–8.57, $P = 0.0002$) being the most predisposing variables respectively. Awareness about water borne diseases showed no association with infection ($P = 0.382$) with typhoid (23.7 %) and fever (2.6 %) constituting the most and least common water borne diseases mentioned by the women. Health education and provision of good water supply should be integrated into the control strategies in order reduce transmission in endemic areas.

Keywords Schistosomiasis · Risk factors · Control · Nigeria

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Introduction

The world-wide cases of schistosomiasis are ~207 million with about 90 % of these cases resident in sub-Saharan Africa (Hotez and Kamath 2009). Nigeria is one of the most endemic regions of Africa with an overall estimate of about 26 million people (Schur et al. 2011). The factors responsible for the spread of schistosomiasis in the tropics are not limited to the interplay between the human host, snail host and the parasite but also of complex demographic, environmental, biological, socioeconomic and cultural processes (WHO/TDR 2008). Since the effective control of schistosomiasis will require multifaceted approach, many endemic areas other than sub-Saharan Africa have adopted this. In Nigeria at best, control focuses on chemotherapy. Although this approach reduces morbidity due to infection by the parasite, reinfection especially in children is inevitable, thus requiring repeated treatment in endemic areas (Gazzinelli et al. 1998). Chemotherapy therefore cannot be solely used to sustain a low morbidity level. Water supply management and good sanitary behavior had been advocated as effective strategies to reduce the disease transmission (Limae Costa et al. 1987), but lack of political will, illiteracy and public awareness in term of health education has caused difficulties in the implementation of this approach.

In Nigeria, *Schistosoma* infection occurs in all human population with prevalence ranging from 9 to 70 % especially in high poverty striking rural areas (Okoli a Odaibo 1999; Mafiana et al. 2003; Salawu and Odaibo 2013a, b). Many of these areas had in one time or the other enjoyed mass drug administration either from the local or state government. Control cannot be sustained due to the underlining factors earlier mentioned. Couple with these factors are, the often school-based control strategies in most endemic areas without due consideration for other risk groups comprising preschool children and pregnant women following the claim that they are not sufficiently exposed to the transmission foci of the parasite. These groups in turn could serve as source of disease transmission to the treated population in resource poor communities thus rendering the area-wide infection prevalence and intensity to pre-control levels. Unlike other studies in Nigeria (Oladejo and Ofoezie 2006; Ugbomoiko et al. 2010) and other parts of the world (Gazzinelli et al. 2006) which considered association between socio-demographic/cultural characteristics and transmission dynamics of schistosomiasis in school children population and the general populace of the endemic communities, the current study focuses on pregnant women population. This becomes necessary as the Ministry of Health of many endemic countries is yet to adopt praziquantel administration in this group. The best approach will be transmission control through reduced human water contact and health education. Therefore this study aims at assessing the knowledge, attitudes and socio-demographic factors associated with *S. haematobium* transmission in resource poor communities of Nigeria in order to proffer an informed decision for best practice to reduce transmission among pregnant women.

Methods

Study area

The study was carried out in Yewa North Local Government Area (LGA), Ogun State, Nigeria. The LGA as previously described (Salawu and Odaibo 2013b) has the largest land mass in Ogun State and population of over 200,000 people. The high prevalence of schistosomiasis in the area has been attributed to lack of potable water supply and presence of snail intermediate host in the natural water bodies (Salawu and Odaibo 2012, 2013b).

Participants and design

The study is a cross-sectional community-based field study conducted between February 1, 2010, and February 15, 2011. The subjects were drawn out of 10 communities randomly selected from a total of 15 in the LGA. The participants were recruited at the primary health centers operating prenatal clinics.

A pilot study making use 30 pregnant women selected randomly from the communities was conducted to determine community prevalence of urogenital schistosomiasis (Salawu and Odaibo 2013b). The observed 30 % prevalence was used to calculate the participants sample size. The precision 0.06 (6 %) was used due to resource limitation (Naing et al. 2006) while statistical power of 80 % was used.

Measures

A pretest structured questionnaire was used to conduct interview in Yoruba or English (as preferred by the interviewee). Pregnant women responses as regards sociodemographic variables, knowledge and attitudes, and water contact activities related to *Schistosoma* infection were recorded. The questions were asked in a manner such that the participants' responses were not influenced by the interviewers.

The participants were given pre-labeled universal bottles for urine collection. A mid-stream urine samples were collected between 10 and 14 o'clock and were transported to the Parasitology Research Laboratory, Department of Zoology, University of Ibadan, for microscopic examination. The samples were well mixed and 10 mL was measured and subjected to centrifugation at 5,000 rpm for 5 min. After removal of the supernatant, the sediments were viewed under a light microscope to determine the presence of terminally spined *S. haematobium* eggs.

Ethical consideration

The study protocol was approved by the Joint Ethics Review Committee of University of Ibadan and University College Hospital, Ibadan, Nigeria. Approvals were also obtained from the Ogun State Ministry Health and traditional heads of the communities. Informed written consents were obtained from the women. Participation in study was solely based on the women voluntariness irrespective of their eligibility. Visitors or those who were not regular residents of the areas were excluded from the study.

Statistical analysis

The data were analyzed using SPSS statistics version 18.0 (IBM, Armonk, NY, USA). The statistical significance of differences in the intensity of infection was determined via ANOVA. Differences in prevalence were tested by the χ^2 test. Multivariate analysis was also conducted, with *S. haematobium* infection as the dependent variable and

sociodemographic variables, water contact and water usage patterns, frequency of visitation, and knowledge about the cause(s) of schistosomiasis as independent variables. Multivariate logistic regression analysis was used to predict the extent of association between variables and the disease occurrence. $P < 0.05$ was considered statistically significant. There was no correction for multiple testing.

Results

Sociodemographic factors and occupation

The mean age of the women was 26.04 ± 5.43 years. The prevalence of urogenital schistosomiasis in the pregnant women was 21.1 % (Table 1). Prevalence and intensity of *S. haematobium* infection was not associated with ages of the women ($P > 0.05$). However, women in age 20–24 years showed a moderate risk to *S. haematobium* infection (OR 1.91, CI 0.99–3.72). No association existed between the women educational attainment and prevalence of infection ($P = 0.267$), but the risk of infection was higher in those with primary school education (OR 1.11, CI 0.59–2.07) and secondary school education (OR 2.45, CI 1.21–4.93) (Table 1). No infection was recorded among those with tertiary education (OR 0.0). Occupation of the pregnant women was associated with prevalence of infection ($P = 0.022$) with farmers (OR 1.23, CI 0.52–2.93), students (OR 1.41, CI 0.36–5.53) and artisans (OR 3.34, CI 1.67–6.69) showing risk of infection. There was no significant difference in the disease prevalence between the Christians and Muslims ($P = 0.083$) however, the Christians showed higher risk of infection (OR 1.69, CI 0.88–3.24) (Table 1). Association existed between human water contact and infection by *S. haematobium* ($P = 0.003$), with all the water contact activities predisposing the women to infection (Table 2).

Water contact, usage patterns and knowledge

Water usage patterns and the frequency of visitation of water bodies are also associated with infection ($P < 0.05$). Multipurpose water usage pattern strongly predisposed the women to infection (OR 4.31, CI 2.17–8.57) (Table 2). However, no association was recorded between trimester/parity of the pregnant women and human water contact

Table 1 Sociodemographic characteristics influencing *S. haematobium* transmission in pregnant women

Variable	Category	No. of respondents	No. of infected	Mean intensity ± SD	Prevalence (%)	OR (95 % CI)
Age	15–19	24	5	21.2 ± 17.3	20.8	0.99 (0.35–2.79)
	20–24	65	19	136.3 ± 254.8	29.2	1.91 (0.99–3.72)
	25–29	60	13	31.2 ± 36.0	21.7	1.05 (0.51–2.16)
	30+	79	13	29.0 ± 34.8	16.5	0.49 (0.23–1.02)
	No response	9	–	–	–	
	Total	237	50	69.6 ± 165.2	21.1	
	P value			0.256	0.10	
Education	Primary	128	28	56.3 ± 148.5	21.9	1.11 (0.59–2.07)
	Secondary	50	16	109.3 ± 215.8	32.0	2.45 (1.21–4.93)
	Tertiary	11	0	0.0	0.0	0.00
	Never	38	6	25.8 ± 14.7	15.8	0.66 (0.26–1.68)
	No response	10	0	0.0	0.0	
	P value			0.475	0.267	
Occupation	House wives	22	0	0.0	0.0	0.00
	Civil servants	9	0	0.0	0.0	0.00
	Farmers	33	8	22.0 ± 17.5	24.2	1.23 (0.52–2.93)
	Traders	114	20	65.3 ± 144.8	17.5	0.66 (0.35–1.24)
	Artisans	48	19	61.4 ± 146.5	39.6	3.34 (1.67–6.69)
	Students	11	3	276.7 ± 448.0	27.3	1.41 (0.36–5.53)
	P value			0.140	0.022	
Religion	Christians	133	33	87.5 ± 200.1	24.8	1.69 (0.88–3.24)
	Muslims	90	17	34.6 ± 39.3	18.9	0.80 (0.42–1.55)
	Traditional	4	0	0.0	0.0	0.00
	No response	10	0	0.0	0.0	
	P value			0.288	0.083	

Table 2 Human water contact activities associated with *Schistosoma* transmission

Categories	No. of respondents	No. of infected	Mean intensity ± SD	Prevalence (%)	OR (95 % CI)
Contacts					
Fetching	73	24	60.1 ± 159.4	32.9	2.04 (0.19–3.51)
Bathing	106	36	69.4 ± 165.4	34.0	1.64 (1.01–2.65)
Laundry	117	38	67.6 ± 161.1	32.5	1.51 (0.94–2.42)
No contact	111	10	24.2 ± 22.3	9.0	0.19 (0.09–0.38)
P value			0.467	0.003	
Water usage					
Single purpose usage	19	3	26.3 ± 21.7	15.8	0.70 (0.20–2.51)
Multipurpose usage	104	35	70.4 ± 167.7	33.7	4.31 (2.17–8.57)
No contact	111	10	24.2 ± 22.3	9.0	0.22 (0.10–0.47)
No response	3	1	30 ± 0.0	33.3	1.94 (0.17–21.82)
P value				0.0002	
Frequency of visitation					
Daily	45	13	80.5 ± 215.5	28.9	1.82 (0.87–3.83)
Weekly	56	16	80.8 ± 159.1	28.6	1.99 (0.99–3.97)
Monthly	22	7	24.7 ± 19.9	31.8	1.98 (0.76–5.17)
No contact	111	10	24.2 ± 22.3	9.0	0.23 (0.11–0.49)
No response	3	2	30.5 ± 0.7	66.7	8.17 (0.73–92.11)
P value			0.09	0.028	

activities and frequency of visitation ($P > 0.05$) (Table 3). No association existed between *Schistosoma* infection and awareness about water borne diseases ($P = 0.382$), however, association existed between infection and awareness about schistosomiasis ($P = 0.012$). Those who claimed awareness about the disease showed risk of infection (OR 2.76, CI 1.38–5.52) with similar result to those who claimed knowledge about the cause of schistosomiasis (OR 10.58, CI 5.22–21.43) (Table 4). Typhoid (23.7 %), cholera (18.4 %), and guinea worm (18.4 %) constituted the highest response on question related to knowledge about water borne diseases while insomnia, fever, and yellow fever each 2.6 % constituted the least response (Fig. 1). The transmission of infection was mostly attributed to dog (46.6 %) and road side/junction urination (24.1 %) (Fig. 2).

Discussion

This study is one of the first population-based studies in Nigeria and Africa relating *Schistosoma* burden to knowledge and water contact activities in pregnant women. Previous studies in Nigeria and other parts of the world focused on transmission patterns in school based resources and in rare occasion the general population (Gazzinelli et al. 1998; Oladejo and Ofoezie 2006; Ugbomoiko et al. 2010). The 21.1 % prevalence of *S. haematobium* recorded showed that it is of a high public health importance in the group as the disease will not only impair the health of the mother but also of the growing fetus. This estimate is higher than the earlier prevalence report 13.0 % by Khalid et al. (2012) in central Sudan but slightly lower than the 23.8 % prevalence reported by Eyo et al. (2012) in Southeastern part of Nigeria. The role of age of women in the transmission of schistosomiasis has earlier been discussed in our previous study (Salawu and Odaibo 2013b). Although no association existed between the pregnant women ages and infection, the lower age categories being the more active groups are more predisposed to infection.

The influence of education, occupation and religion on schistosomiasis in pregnant women is similar to that of the general population. A poor level of education appears to be a risk factor for urogenital schistosomiasis in Nigeria in present study, intestinal schistosomiasis in Brazil (Bethony et al. 2001) and many other parasitic diseases throughout the developing world (Montresor et al. 2001; Asaolu and Ofoezie 2003; Stothard et al. 2006; Aagaard-Hansen et al. 2009). This association is probably multi-faceted, education affecting attitudes and behavior in different ways in different settings (Ugbomoiko et al. 2010). In Yewa North LGA, individuals with low educational status are more likely to cross a stream or river barefoot and spend longer hours in water (exposing themselves to cercarial penetration) than their more educated counterparts, an observation similar to practices in Eko-ende and Ore in Osun State reported by Ugbomoiko et al. (2010). The self-awareness of those with tertiary education could have resulted in the zero prevalence observed among them.

Table 3 Associations between trimester/parity and water contact activities and frequency of visitation in pregnant women

Categories	Trimester no. (%)			Total	*P* value	Parity no. (%)			Total	*P* value
	1st	2nd	3rd			Primi	Second	Multi		
Water contact[a]										
Fetching	1 (1.5)	22 (32.8)	44 (65.7)	67	0.974	19 (27.1)	9 (12.9)	42 (60.0)	70	0.845
Bathing	2 (2.0)	28 (27.7)	71 (70.3)	101		33 (32.0)	17 (16.5)	53 (51.5)	103	
Laundry	2 (1.8)	30 (27.0)	79 (71.2)	111		34 (29.8)	18 (15.8)	62 (54.4)	114	
Frequency of visitation[b]										
Daily	1 (2.3)	12 (27.9)	30 (69.8)	43		9 (22.0)	11 (26.8)	21 (51.2)	41	0.219
Weekly	–	13 (24.1)	41 (75.9)	54	0.663	20 (36.4)	7 (12.7)	28 (50.9)	55	
Monthly	1 (4.5)	5 (22.7)	16 (72.7)	22		6 (26.1)	3 (13.0)	14 (60.9)	23	

[a] Multiple response

[b] Single response

Table 4 Knowledge and awareness about schistosomiasis among pregnant women

Categories	Response	No. of respondents	No. of infected	Mean intensity ± SD	Prevalence (%)	OR (95 % CI)
Awareness on water borne diseases	Yes	36	6	150.2 ± 315.9	16.7	0.71 (0.28–1.82)
	No	201	44	58.6 ± 135.9	21.9	1.40 (0.55–3.58)
	P value			0.356	0.382	
Knowledge on cause of schistosomiasis	Yes	50	17	112.4 ± 234.1	34.0	10.58 (5.22–21.43)
	No	185	29	52.0 ± 120.6	15.7	0.38 (0.19–0.77)
	No response	2	0	0.0	0.0	0.00
	P value			0.024	0.04	
Awareness on schistosomiasis	Yes	132	37	81.1 ± 190.1	28.0	2.76 (1.38–5.52)
	No	105	13	36.6 ± 37.0	12.4	0.36 (0.18–0.73)
	P value			0.117	0.012	

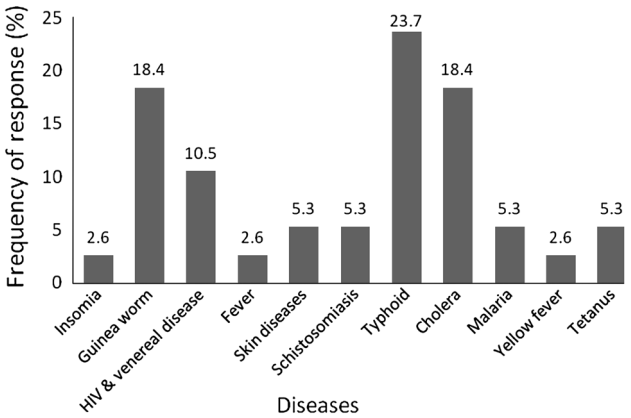

Fig. 1 Knowledge about water borne diseases among pregnant women

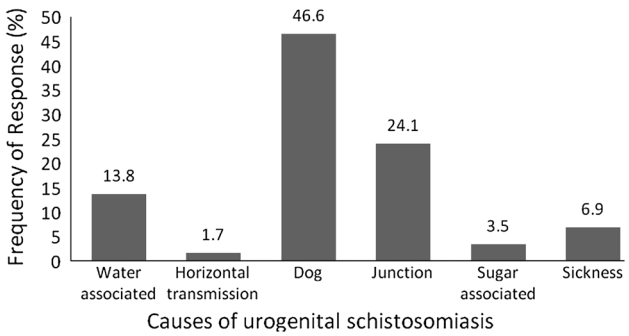

Fig. 2 Frequency of responses of pregnant women to the causes of urogenital schistosomiasis

Water-contact behaviors may also be linked to occupations as students (mostly secondary schools) fell among the most infected groups. These form the most active group who also engage themselves in most risky human water-contact behaviors. Some of the responsibilities given to the artisans (mostly apprentice) by their trainers which may also include fetching and washing in river sources could have also predisposed them to higher infection by *S. haematobium.* The higher prevalence and risk of infection among the Christian pregnant women was also similar to

other studies in Nigeria (Fatiregun et al. 2005; Ugbomoiko et al. 2010). The presence of significant number of certain Christian religion sect who sometimes observes 'holy bath' could have been responsible for the higher prevalence. The seclusion of Muslim women by some Muslims husbands could have led to lower rates of schistosomiasis due to less exposure to natural water sources (Michelson 1993).

The lack of association between prevalence of urogenital schistosomiasis and awareness of pregnant women about other water borne diseases suggests lack of measures to curtail the spread of such diseases regardless of their level of awareness. This was further reflected in the occurrence of more than half of the population that made use of river water (whether as only source or in combination with other sources of water supply) and over 80 % of the population who visited river bodies daily/weekly (data not shown). The high dependence of the population on natural water bodies avails each water contact activity a potential risk factor of *S. haematobium* transmission in the pregnant women. The 34 % of the pregnant women who claimed knowledge about the cause of urogenital schistosomiasis was an over estimation as less than 10 % actually knew the real cause of the disease on further analysis of the participant's response. For example more than 80 % of the participants believed that a healthy person will contract infection by urinating where dog once urinated or by urinating at junctions! This high level of ignorance has also been reported in other studies in different parts of Nigeria (Mafiana et al. 2003; Oladejo and Ofoezie 2006; Ugbomoiko et al. 2010).

Conclusion

It is obvious in this study that control intervention is a must in this group of population. A productive and sustainable intervention however cannot be achieved without adequate education. This can best be achieved by first of all training of the grass-root health workers on the transmission and control of schistosomiasis. Since provision of good water supply and other amenities may not completely bring the needed results as majority of these people still cherish natural water supply even in the presence of safer alternative sources of water, this enlightenment should be extended to all the risk groups including women. Alertness of the women about the harmful effects of schistosomiasis during pregnancy on fetus and maternal well being and providing them with information on the risky behaviors for acquiring infection will help to reduce frequency of water contact in the group. Also women in endemic areas should be carried along in the design, implementation and evaluation of schistosomiasis control intervention in view of their important educational role and as mothers and main users of water supply. All of this will compliment the intervention programs.

Acknowledgments The present study was partly funded by a University of Ibadan multidisciplinary Grant from the MacArthur Foundation awarded to A.B.O., and a University of Ibadan Postgraduate School Scholarship awarded to O.T.S. The study forms part of O.T.S's doctoral thesis.

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