International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 4, Issue 3 - 2017

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2017.04.03.019

Challenges of soil- transmitted Helminthiasis in some communities in Ondo state, Nigeria

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Abstract

Soil- transmitted helminthiasis is a common public health challenge of developing countries. It has largely contributed in undermining the health status of people and hence jeopardized the economic development of countries concerned. This study aimed at investigating the burden of soil-transmitted helminthiasis in some selected rural communities in Ondo State Nigeria. This study was carried out to determine the prevalence of human soil- transmitted helminthiasis. Stool samples were collected and processed using stool concentration - formalin-ether sedimentation method. Out of the 928 samples collected from volunteers, 149 (16.05%) were infected. The following parasites were isolated: *Ascaris lumbricoides*, 103(53.7%) 64(33.3%), *Trichuris trichiura* 17(8.9%) and *Strongyloides stercoralis* 8(4.17%). Among the risk factors, toilet and water resource facilities were the major sources of transmission. The result obtained justifies the current state of the poor hygiene level in relation to high occurrence rate of Soil-transmitted helminths among people living in the rural settings.

Keywords: Soil-transmitted helminths, *Ascaris lumbricoides*, helminthiasis, Ondo, Nigeria

1. Introduction

Soil-transmitted helminths (STHs) have been reported as one of the world's most important causes of physical and intellectual growth disturbances of people living in area with poverty in the developing world. STHs are a group of parasitic nematode worms known to cause human infection via contact with parasite eggs or larvae. The larva of STHs thrives in warm and moist soil environment of tropical and subtropical countries of the world. As adult worms, the soil-transmitted helminthes live for years in the human gastrointestinal tract (Bethony, 2006).

The roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*), and hookworms (*Necator americanus* or *Ancylostoma duodenale*) have been considered to be of major concern on the worldwide scale. More than a billion people are infected with at least one species (WHO, 2005). Studies have also highlighted the profound effect of soil-transmitted helminths infection on school performance and attendance and future economic productivity (Miguel & Kremer 2003).

Reports have shown that the triad of *Ascaris lumbricoides*, *Trichuris trichiura*, and the hookworm species are common infections in Nigeria. It has also been reported that the prevalence rate of these STHs differs from region to region (Omorodion *et al*., 2012). Nigeria has been reported to have the highest number of people infected with STHs in the sub-Saharan Africa (Drake *et al*., 2000; Drake & Bundy 2001; Jukes, 2002). Although, there are several studies on the prevalence of STHs in Nigeria, but the fact still remains that there are still areas or communities of some regions where epidemiological information is under represented. Majority of Nigerian children having infection with intestinal parasites have been shown to be from low socio-economic class and had been found to be malnourished, anaemic, stunted with retarded growth and underweight (Nmorsi, 2009).

Important determinants of transmission of these infectious agents as described by Brooker *et al.* (2006) include climate, adequate moisture and warm temperatures which are essential for larval development in the soil. Poverty, inadequate water supplies and poor sanitation have also been reported as part of the important determinants (Salawu, 2015). Such infections might also increase host susceptibility to other important illnesses such as malaria, tuberculosis, and HIV infection (Fincham, 2003).

Adult hookworms of the genera *Necator* and *Ancylostoma* parasitize the upper part of the human small intestine, whereas Ascaris roundworms parasitize the entire small intestine and adult trichuris whipworms live in the large intestine, especially the caecum. The parasites can live for several years in the human gastrointestinal tract. Human beings are regarded as the only major definitive host for these parasites.

The soil-transmitted helminths vary greatly in size, and female worms are larger than males. After mating, each adult female produces thousands of eggs per day, which leave the body in the faeces.

Helminthic infection could result in down regulating host immunity, protecting themselves from elimination and minimizing severe Pathology in the host (Maizels & Yazdanbakhsh 2003).

Despite the educational, economic, and public-health importance of helminthiasis, they remain largely neglected by the medical and international community. This neglect stems from three features: first, the people most affected are the world's most impoverished, particularly those who live on less than US$2 per day; second, the infections cause chronic ill health and have insidious clinical presentation; and third, quantification of the effect of soil-transmitted helminthic infections on economic development and education is difficult (WHO, 2005).

Over the past 5 years, however, the worldwide community has begun to recognize the importance of these infections after revised estimates showed that their combined disease burden might be as great as those of Malaria or Tuberculosis (Chan, 1997).

This study was undertaken to identify, assess, and evaluate the prevalence and epidemiologic factors relating to intestinal helminthiasis in Ondo State, Nigeria.

2. Materials and Methods

2. 1 Study area

This research work was carried out on the students and teachers of JOORO Community Grammar School Ibule-Soro, Community Comprehensive High School Ilara-Mokin and patients attending clinics at, the State Specialist Hospital, Akure Ondo State, Nigeria. Ibule-Soro and Ilara-Mokin are small towns with traditional rulers, located very close to Akure, within Ifedore Local Government Area of Ondo State. These study sites are located between latitude 5˚30 and 5˚35'S and longitude 7˚15'and 7˚. Study sites were visited several times for the purpose of community mobilization.

2.2 Study Population

The study population comprised of children, teenagers and adult based on age groups across various social class (Table 1).

Table 1 Demographic characteristics of the study population

Characteristic	Frequency (*n*)	Percentage (%)
Age group (Years)		
9 – 14	287	30.9
15 – 20	188	20.3
21 – 26	150	16.2
27 – 32	172	18.5
33 – 38	95	10.2
>39	36	3.88
Gender		
Male	366	39.4
Female	562	60.6

2.3 Ethical clearance

The ethical permission/clearance was obtained from Ondo State Ministry of Health and Ifedore Local Government Headquarters before the commencement of the field study. Written consents were duly obtained from individual participants.

2.4 Sample collection and processing

Stool samples from volunteers were collected in a dry wide mouth, clean universal bottle. A speck (about 2 mg) was picked with a swab stick and smeared in a drop of normal saline on a clean glass slide, covered with a cover-slip and examined for eggs and larvae of helminthes under a light microscope using x10 objective and confirmed by x40 objective.

The stool sample was prepared using stool concentration - formalin-ether sedimentation method. One gm of faeces was thoroughly mixed in 10 ml of normal saline (0.85% NaCl) and strained through gauze of sieve pore 750 µm in a funnel. The filtrate was centrifuged at 2000 rpm for 2 minutes, the supernatant was discarded and the sediment was re-suspended in 7 ml of normal-saline for 10 mins, to this was added 3 ml of ether, shaken vigorously to mix and centrifuged at 2000 rpm for 2 minutes. The upper debris was removed with the supernatant while the sediments was shaken together and poured on a clean glass slide, covered with cover slip and examined under microscope for eggs and larvae of helminthes. Total numbers of eggs were counted as numbers per gram of faeces.

2.5 Statistical Analysis

Statistical analysis of the data obtained in this study was performed suing the Statistical Package for Social Sciences (SPSS) version 22. Two categorical variables were comparatively analysed using chi-square test. The level of significance of each test was set at $p<0.05$.

3. Results

Ascaris lumbricoides has the highest prevalence in light intensity mean as (646.81) and heavy intensity mean (866.66), as against Hook worm whose light intensity mean as (400.00) and heavy intensity mean as (600.00). *Trichuris triichiura* has light intensity mean as (309.00) while heavy intensity mean as (800.00). *Strongyloide starcoralis* has light intensity mean as (342.85) with heavy intensity mean as (800.00) Table 2.

Table 2. Prevalence of intensity of intestinal helminthic infection in the study areas.

Parasite	Intensity	Total no. infected	% infected	Mean
Ascaris lumbricoides	Light Moderate Heavy	47 26 30	24.47 13.54 15.63	646.81 300.00 866.66
Hookworm	Light Moderate Heavy	35 11 18	18.23 5.73 9.38	400.00 309.00 600.00
Trichuris trichuira	Light Moderate Heavy	11 5 1	5.73 2.60 0.52	309.00 440.00 800.00
Strongyloides stacoralis	Light Moderate Heavy	7 0 1	3.64 0.00 0.52	342.85 0.00 800.00

Light = 1-2 egg/gram epg
Moderate = 3 egg/gm epg, Heavy = 4 and above egg/gm epg

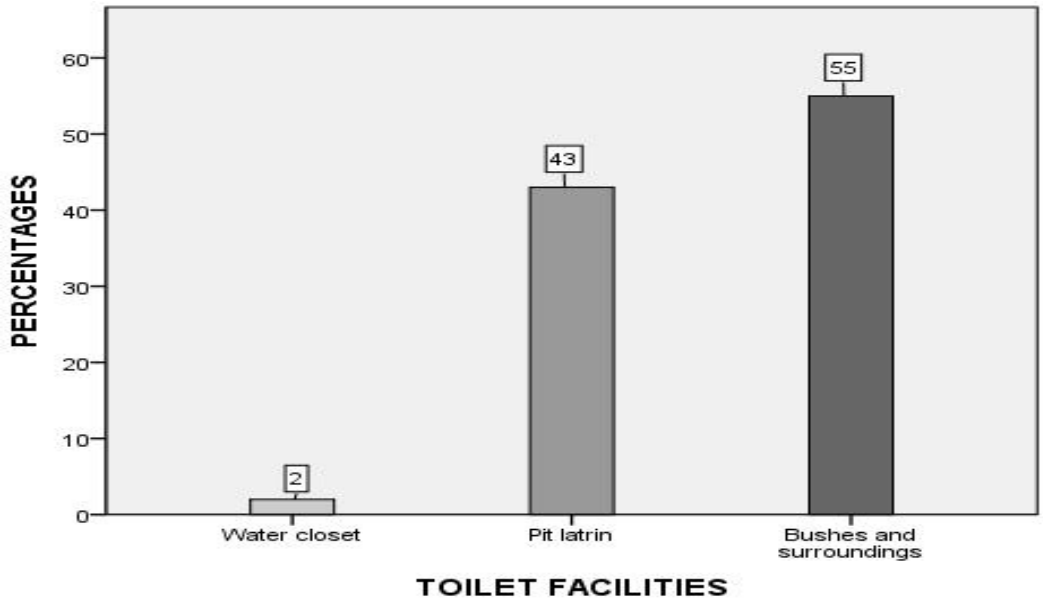
A total of 928 volunteers including children, teenagers and adult were recruited for this study. Of all the subjects, 149(16.1%) were infected with the following helminthes *Ascaris lumbricoide*s, Hookworm, *Tricuris trichiura* and few *Strongiloides starcoralis.* Subjects within the age bracket 9-12years have the highest prevalence of infection in females 107 (28.9%) than males 68 (17.6%). The total data showed a higher prevalence in females 93 (15.1%) than in males 56 (13.4%). The age group with the highest prevalence in this table is 9 – 12 and 16-18 years (24.5%) at $p < 0.05$ as shown in Table 3.

Table 3 Prevalence of soil-transmitted helminthiasis among the study subjects.

	MALE		FEMALE		TOTAL	
Age group (Years)	**No. examined**	**No. Infected (%)**	**No. examined**	**No. Infected (%)**	**No. examined**	**No. Infected (%)**
9 – 14	120	23(19.2)	167	51(30.5)	287	74(25.8)
15 – 20	79	22(27.9)	109	27(24.8)	188	49(26.1)
21 – 26	54	6(11.1)	96	7(7.29)	150	13(8.67)
27 – 32	54	2(3.70)	118	4(3.39)	172	6(3.49)
33 - 38	31	2(6.45)	64	3(4.69)	95	5(5.26)
>39	11	1(9.1)	25	1(4.0)	36	2(5.56)
Total	**366**	**56(15.3)**	**562**	**93(16.5)**	**928**	**149(16.1)**

Chi $x^2 = 102.36$ $p < 0.05$

Of the 149 infected persons, 3(2.01%) uses water closet, 64(42.95%) and 82(55.03%) uses bushes and the surrounding environment (Figure 1).



f(3), Chi χ^2 =132.36, p<0.01

Figure 1. Toilet facilities of volunteers with soil- transmitted helminthes in the study areas.

The overall prevalence of helminthic infection was higher in Ibule-Soro 106 (26.50%) than others. Ilara-Mokin has the prevalence of 30 (23.43%) while Akure had the least 13 (3.25%). *A lumbricoides* has the highest prevalence in Ibule-Soro 63(15.75%) followed by Ilara-Mokin 28(21.8%) while Akure has the least prevalence 12(3.0%). Hookworm infection had highest prevalence in Ibule-Soro 56(14.00%) followed by Ilara Mokin 8 (6.25%), while Akure had none. *T. trichiura* had 13 (3.25%) in Ibule, 4(3.13%) in Ilara Mokin and none in Akure. *Strongyloides starcoralis* was scanty in Ilara 7 (5.47%), 1(0.25%) in Akure and none in Ibule (Table 4). Subjects with double infections is higher 47(31.54%) compared to the subjects with multiple infections 1(0.67%) Table 5.

Table 4 Prevalence of helminthic infections in the study area

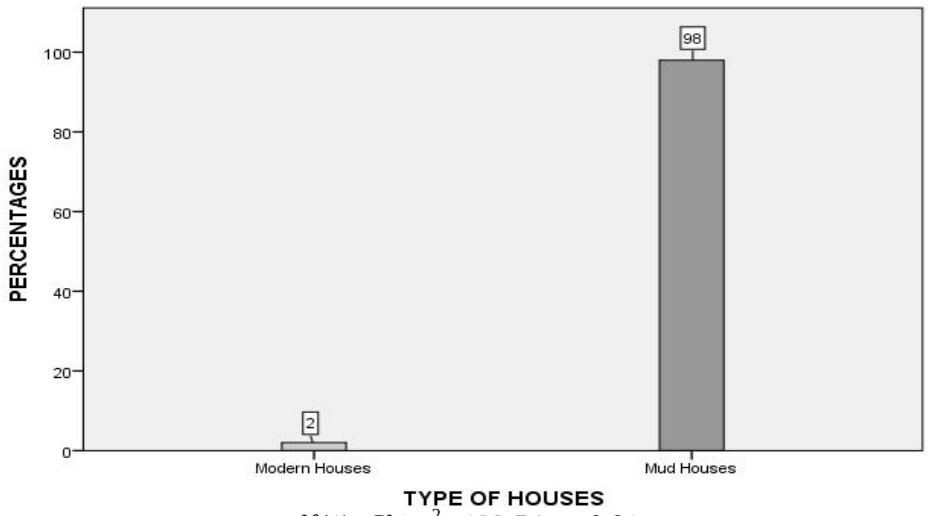
Sex/Area	No. examined	No. Infected (`%)	Prevalence of Helminthes (%)			
			A. lumbricoides	Hookwarm	*T. trichuria*	Strongiloids
Male						
Akure	142	**4(2.81)**	3(2.12)	-	-	1(0.70)
Ibule	200	**57(28.50)**	26(13.00)	26(13.00)	4(2.00)	-
Ilara	44	**12(27.27)**	11(25.00)	3(6.81)	3(6.81)	3(6.81)
Female						
Akure	258	**9(3.48)**	9(3.48)	-	-	-
Ibule	200	**49(24.50)**	37(18.50)	30(15.00)	9(4.50)	-
Ilara	84	**18(21.42)**	17(20.23)	5(5.95)	1(1.19)	4(4.76)
Total						
Akure	400	**13(3.25)**	12(3.00)	-	-	1(0.25)
Ibule	400	**106(26.50)**	63(15.75)	56(14.0)	13(3.25)	-
Ilara	128	**30(23.43)**	28(21.8)	8(6.25)	4(3.13)	7(5.47)

Table 5. Soil-transmitted helminths of double and multiple infections identified among subjects.

Parasite	Frequency (*n*)	Percentage (%)
A. lumbricoides and Hook warm	47	31.54
A. lumbricoides, Trichuris and Hookworm	1	0.67

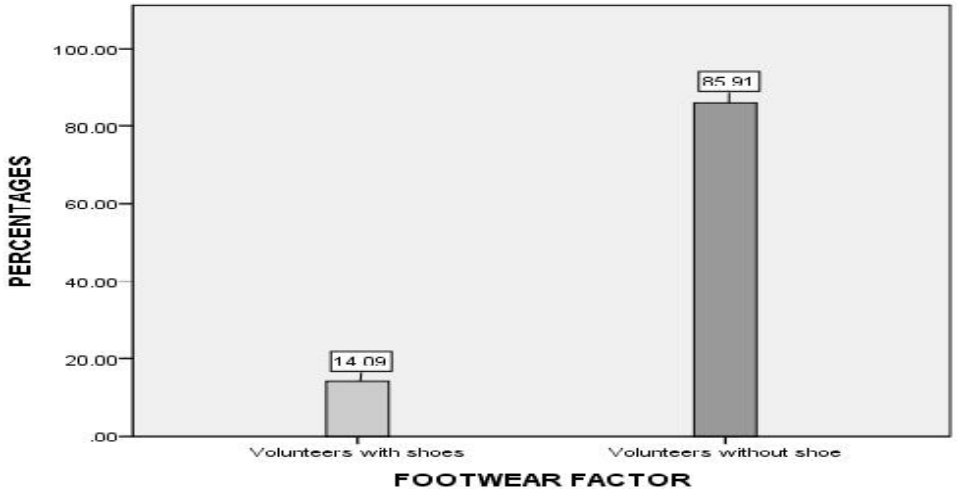
Figure 2 Shows that those that lived in modern houses are 3(2%) of the infected subjects while those that live in mud houses are 146 (98%) of the infected subject.

Out of the 149 of the total infected subjects, people wearing shoes are 21(14.09%) while people that walk.



df(1), Chi x^2 =122.54, p<0.01

Figure 2. Housing Facilities of Volunteers with Soil- transmitted helminthic infection in the study area.



df(1), Chi χ^2 =127.98, p<0.01

Figure 3. Foot protection factors as it affects volunteers in soil- transmitted helminthes in the study areas.

4. Discussion

The Data obtained in this study showed variability in the prevalence rate of the soil transmitted helminthiasis as Akure had lower rate than Ilara-Mokin and Ibule-Soro. This pattern is related to the levels of personal and environmental hygiene observed in the localities. The statistical analysis showed the toilet facilities to be significant and can be said to be a risk factor in the investigation of soil-transmitted helminthic infection. This is in agreement with previous reports [Williams-Blangero, 2002; Bethony, 2006; Nmorsi, 2009).

Predominance of *Ascaris lumbricoides* followed by hookworm as reported in this study is in consonance with other findings in Nigeria (Nmorsi, 2009; Eneanya & Anikwue, 2005). The reason could be attributable to the fact that the ova of *A. lumbricoides* and hookworm can withstand a high variety of adverse environmental conditions; which makes it possible to keep the infection endemic in the community. This is encouraged by the water pollution in the area because of indiscriminate defecation.

The high prevalence rate of infection in Ibule – Soro may be associated with their occupation and poverty rate in the land as the people are predominantly farmers, with some children walking bare-footed. They depend solely on stream water for drinking, and washing which may be polluted from source with waste products. In addition, poor sanitary and environmental conditions as evidenced in this study are known to be relevant in the propagation of these infectious agents (Phiri, 2000; Omorodion *et al*., 2012)

This result differs from Adeyeba and Essiet (2001), who gave reasons for the low prevalence rate recorded among school Children in Igbo-Ora in Oyo State in Nigeria. It was attributed to the use and abuse of drug administration which may account for the low shedding of eggs by infected people thereby giving a false impression of low infection rate in the study area.

The high prevalence of helminthiasis in children between the age-group of 9-14 in this study may be associated with the playing activities of the children at backyards and farms making them more at risk. Their level of sanitary information is also low compared to other age brackets. This agrees with the findings of Holland *et al*. (1989) who observed that the bulk of helminthic infections was within 10-15 years while Beaver (1984) stipulated that though all ages can be infected, but infections is more common among children than in adults.

It was also noted that the prevalence rate of infection was higher in female than male. The result agrees with some previous findings (Gandhi *et al*.,. 2001). Hormonal, immunological and mechanical factor had been suggested to play a role in limiting infection in females (Odebunmi *et al*., 2007). However, high prevalence rate as evidence in this study might be due to the domestic work load of female, such as food preparation, cleaning of surroundings and fetching of water from polluted streams. There is increase risk of infection, especially when they work barefooted in their compound (Jamil 1999).

Conversely, in Iredore local government area where the two schools investigated are located; it was observed that female subjects culturally engaged in farming activities than their male counterpart. This then renders females more at risk.

5. Conclusion

In conclusion, the challenges of soil-transmitted helminthiasis found in these communities Ilara Mokin, Ibule – soro and Akure as evidenced in this study reflects poor living conditions, poor personal and environmental hygiene, inadequate health services, and inadequate sanitation, poor sewage disposal system and water supply facilities.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Quick Response Code	Subject: Parastiology
DOI:10.22192/ijarbs.2017.04.03.019	

How to cite this article:
AKINSEYE, F. J, EGBEBI, A.O, FADARE, O.S. (2017). Challenges of soil- transmitted Helminthiasis in some communities in Ondo state, Nigeria. Int. J. Adv. Res. Biol. Sci. 4(3): 164-171.
DOI: http://dx.doi.org/10.22192/ijarbs.2017.04.03.019