



Soil-transmitted helminthes among primary school children in Owo metropolis

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ABSTRACT

Background: Soil-transmitted helminthes [STHs] are public health challenges in the tropical and subtropical developing countries. Approximately, two billion people are infected as of 2010 and four billion at risk. **Aim:** To determine the prevalence of helminthic infection among school children with a view to generate epidemiological data that can be used for effective control plan in Owo. **Methods:** Two schools were picked randomly from various schools in the community. The questionnaire was administered to every participant by interview. A total number of 250 samples were studied. The prevalence of STH infections was assessed among school children in Owo, South-Western Nigeria, using standard parasitological techniques. **Results:** Of the 250 children examined, 45[18.0%] had helminth infections. The helminthes identified were *Ascaris lumbricoides* 33[13.2%], hookworm 10[4.0%] and *Enterobius vermicularis* 2[0.8%], and mixed infections of *Ascaris* and Hookworm 3[6.67%]. Females had higher prevalence rate of 29 [21.32%] compared to the males with the rate of 14 [12.26%] which was statistically significant [$p < 0.05$]. The 8-12 years age group recorded the highest infection rate of 27[29.34%]. **Conclusion:** STH is being actively transmitted among children in Owo metropolis. The prevalence of intestinal helminth infection was higher in government owned rural schools than in government owned urban schools. There was poor socio-economic status, poor hygienic habit and high unskilled occupation among parents of the infected pupils in the study area. Hence, there is need for periodical health education and mass treatment for the effective control of intestinal helminth in the study area.

Key words: Helminthes, school-age, tropical diseases, parasite, WHO, infection



INTRODUCTION

Soil-transmitted helminthiasis [STH] is a collection of human parasitic infections caused by intestinal roundworms such as hookworms [*Ancylostoma duodenale* and *Necator americanus*], ascaris [*Ascaris lumbricoides*], and whipworm [*Trichuris trichiura*].^[1] It is transmitted through contaminated soil.^[1] It is the most common human parasitic infection globally.^[2] “Approximately, two billion people [about a third of global population] are infected as of the latest estimate, and four billion at risk, surpassing even the all-time most prevalent parasitic disease, malaria”.^[3,4] It is prevalent in impoverished rural areas of Sub-Saharan Africa, Latin America, Southeast Asia, and China.^[5] It is a common cause of physical and intellectual retardation.^[5] It is transmitted through ingestion of the nematode eggs in the soil which is contaminated through excrements.^[4,5] Hence, this infectious disease is commonest in warm and moist climates with poor sanitation and hygiene, and also in the temperate zones during warmer months. “STH is a Neglected Tropical Disease because it inflicts tremendous disability and suffering, which can be clinically treated, yet negligible attention has been given for many years”.^[6]

Globally, STHs pose a major public health challenge, especially in the developing countries. “The World Health Organization in 2013 estimated that more than one billion of the world's population is chronically infected with soil-transmitted helminthes and another two billion are at risk”.^[2, 3] Faecal matter-polluted soil plays a major role in the transmission of the infection.^[8, 9] “Soil pollution and soil-transmitted helminthes are facilitated where poor domestic/environmental sanitation and personal hygiene, poverty, and low levels of education exist, among other factors”.^[10] “According to the United Nations Development Programme report in 2006, some 1.1 billion people in developing countries have inadequate access to water and another 2.6 billion lack basic sanitary facilities”.^[3, 10] About 50% of people in developing countries are affected at a point in time by water and sanitation related health problems.^[10,11] “More than one dozen different species of soil-transmitted helminthes infect humans, especially in the tropical and subtropical parts of the developing world”.^[11, 12]

Owo is located in tropical rainforest where relative humidity is high, semi-urban setting with low sanitary system or facilities and waste disposal is inadequate. Several studies has shown that soil transmitted helminth is one of the neglected parasitic diseases present in children and study into it will be of benefit to both parents and health workers. No study has been documented in Owo with regards to soil transmitted helminthes. It is against this background that this study is designed to determine the prevalence rate of helminthic infection among school children with a view to generate epidemiological data that can be used for effective control plan to eradicate or minimize the menace of soil transmitted helminthes in this community or locality.

METHODOLOGY

Study area

The study was conducted on public school children in Owo Local Government Area of Ondo State. Owo is about 51km from the capital of Ondo state. It lies on latitude 7.2° N on the equator and longitude 5.6°E at an elevation/altitude of 348 above sea level meters.^[13] Two schools were picked randomly from various schools in the community. There are two seasons; the wet season which is between April and October, and the dry seasons which is between November and March. The average annual rainfall is about 1300mm and average atmospheric temperature of 30°C.^[13]

Population of study area

“The area is traversed by a number of streams and rivers which constitute the major source of water supply to all the communities in the area”.^[13] The area lacks basic amenities. The major economic activities in the area are farming and trading. There is a low level of education status attained by inhabitants. From population projection of 2006 National census, the population of the community was 276,574 inhabitants.^[13]

Sample size

A total number of 250 samples were studied. The sample size was determined by the formula $N=4Pq/l^2$, Where N=sample size, P=Prevalence of previous study, q=1-p, l=permissible error [5% of p].^[14-19]

Ethical clearance

Ethical clearance and approval was obtained from Owo Local Government Education Authority and Ethical committee of Federal Medical Center, Owo, Ondo state. Informed consent was also sought and obtained from the communities and subjects to be used for the study.

Mobilization and advocacy visits

The chiefs of the community were informed and mobilized for the study by personnel from Achievers University. After getting the permission from the leaders the market women also were mobilized.

Validity of instrument

The validity of the instrument was done by 3 experts, the supervisor, a community health expert and 2 experts in measurement and evaluation from the department of nursing sciences. The structured questionnaire was submitted to them for face and content validity and all adjustment and corrections were made and approved by the supervisor before administering the instruments to the respondents.

Reliability of instrument

The reliability of the instrument was established using split-half method. The instrument was administered once to thirty [30] students in the Owo Local Government Area who were not part of the sample whose population characteristics are similar to the ones in the study. The instrument was collected and divided into two halves using even and odd numbers of items in the instrument. One half [15 each] were the even numbers while the other half [15 each] were odd numbers. The two scores from the 15 even numbers and 15 odd numbers questionnaires were used to compute the reliability coefficients of the instrument using Pearson's product moment statistics. The reliability coefficient of [r] 0.78 obtained was deemed adequate.

Administration of questionnaires

The questionnaire was administered to every participant by interview. Pupils between ages 5-18years were selected for competence in responding to the questions asked. The selected pupils were interviewed individually. When necessary, the questions were communicated in the local language for ease of understanding. The teachers helped to confirm the names, and ages of the pupils

from the class register. A total of 250 students were involved.

Sample collection

All the pupils in the selected primary schools were invited to participate in the study. Exclusion criteria included refusal to give consent either by the parents or the pupils. Also any students that are have taken treatment in the last two months. For every recruited pupil, demographic data were recorded and a unique identification number was assigned. The stool sample was collected into sterile wide mouth bottle [properly labeled with corresponding ID number] from each of the pupil on each collection day. The samples were transported to the laboratory in black polythene immediately for analysis.

Stool examination

Macroscopic examination

The colour of the specimen, consistency, presence of blood, mucus, pus and adult worm or parasites was observed for in the stool sample.^[14, 20]

Wet preparation method

A drop of normal saline and iodine were placed on each end of a slide respectively and a small amount of the stool was picked with an applicator stick and emulsified on the slide, it was then covered with a cover slip and examined under the microscope using the $\times 10$ and $\times 40$ objective with the condenser iris closed sufficiently to give good contrast. This method is used for the identification of helminth eggs, larvae, cysts, and oocysts.^[15, 20]

Formol ether concentration method

Using an applicator stick, an estimated 1g of faeces was emulsified in about 4ml of 10% formol water, 3-4ml of 10% v/v formol water was further added and mixed well by shaking, the emulsified faeces was sieved into another tube. 3-4ml of diethyl ether was added. The tube was covered and mixed for 1 minute. The stopper was loosened and centrifuged immediately at 3000rpm for 1 minute. Using a stick, the layer of faecal debris was loosened from the tube. The tube was then inverted to discard the ether, faecal debris and formol water. The bottom of the tube was tapped to re-suspend and mix the sediment. The sediment was transferred to a slide and covered with a cover slip. It was examined microscopically using the $\times 10$ and $\times 40$ objective for the identification of small eggs and cysts.^[17, 18, 19, 20]

Statistical analysis

The relationship between the variables were analysed using the chi-square analysis, while descriptive statistics [Bar-chart] was used to depict the frequency of the variables. All data were analysed using Statistical package for social sciences [SPSS] 17.0 version.

RESULTS

Prevalence of intestinal helminthic infections

Out of the 250 subjects examined, 45[18.0%] had intestinal helminth infections. Three helminthic parasites were identified namely *Ascaris lumbricoides*, *Ancylostoma duodenale* [Hookworm] and *Enterobius vermicularis* [P=0.005]. In the total population, *A. lumbricoides* had significantly highest prevalence of 33[13.2%], while *A. duodenale* had a prevalence of 10[4.0%] and the least prevalence was observed in *E.vermicularis* 2[0.8%] as presented in table 1 below.

Prevalence of helminthic infections in relation to the gender of the subjects

The total prevalence of *A. lumbricoides* among male pupils, which was 10[8.8%] was significantly different [$p < 0.05$] from the total prevalence among female which was 23[16.9%]. Similarly, the total prevalence of *A.duodenale* [Hookworm] among males 4[3.5%] was not statistically significant [$p > 0.05$] from the total prevalence among females which was 6[4.4%]. *E. vermicularis* was observed only in male subjects with a prevalence of 2[1.8%]. A significant difference [$p = 0.043$] exist between parasitic infection and gender of the pupils [table 2].

Prevalence of helminthic infections in relation to the age of the subjects

The highest prevalence of *A. lumbricoides* 19 [20.7%] was observed among 8-12years age groups, the highest prevalence of Hookworm and *E.vermicularis* [6.5%, 2.2% respectively] was recorded among the age group of 8-12years. This study revealed that this is no statistical significant between age group and prevalence of infection in the studied population [P=0.028] [table 3].

Mixed helminthic infections present in the subject

Among the infected subject the prevalence of mixed infection due to *A.lumbricoides* and Hookworm was 3[6.67%]. The prevalence of

mixed infection due to *A.lumbricoides* was 2[66.7%] and the prevalence due to Hookworm infection was 1[33.3%]. This is presented in table 4.

Demographic status of the subjects

Questionnaire administration on the examined subject revealed that most of the subject at rural school in Ute, obtained their drinking waters from well and nearby streams. Most of the parent of the subjects were artisans and farmers 187[73.6%], while 66[26.4%] of the parent were civil servants. 70% of the subjects practised indiscriminate and open defecation. 59.6% of the subjects indulge in fingernail nibbling, 83.6% used a kind of footwear while only 33.6% washed their hands after defecation. This data is presented in table 5.

Distribution of body mass index in relation to helminthic infection among the participant

The highest prevalence of *A.lumbricoides*, Hookworm and *E.vermicularis* [13.3%, 3.8%, 1.3% respectively] was observed among subjects with BMI between 1.0-2.0 [figure 1].

Distribution of intestinal helminthes observed in relation to the school examined

The overall prevalence of helminth infection at Urban school was 24.8%. Out of which 16.8% of the subject had Ascariasis, 6.4% had Hookworm infection while 1.6% of the subject were infected with *E.vermicularis*, 2.4% had mixed helminth infection. The overall helminth prevalence at Government Urban school at Oja-Oba was 11.2%, in which 9.6% were infected with *A.lumbricoides*, while 1.6% were infected with Hookworm. A Statistical significant difference exist between helminth infections and the schools used in the study [P= 0.05] [figure 2].

Prevalence by socio-demography

This study revealed that was no statistical significant difference in the prevalence of soil transmitted helminthes between urban and rural students [P = 0.36]. Also, no significant difference was observed in gender between urban [P = 0.23] and rural [P = 0.23] schools as well as between age groups in urban [P = 0.93] and rural [P = 0.48] schools and students. Prevalence of soil transmitted helminthes in Owo Metropolis by demographic characteristics is prearranged in table 6.

The present study showed a Statistical significance between soil transmitted helminthes in Owo Metropolis and socio-economic status of the students are given in table 7. The investigation revealed a very high rate of unskilled occupation among the parents in the study area, urban 100 and rural 84. A statistically significant correlation between unskilled work and incidence of soil transmitted helminthes in Owo Metropolis was observed in urban students [P = 0.04]. The

level of education of the mother was also taken into consideration since it is the mother who looks after the children. A higher prevalence of infection was noted in students whose mothers had primary school education and the prevalence rate was higher in rural students [13.8%] than urban [11.7%]. There was a significant relation between a mother's level of education and soil transmitted helminthes in Owo Metropolis among rural students.

Table 1: The prevalence of intestinal helminthic infections in this study

Total number examined	<i>A.lumbricoides</i>		Hookworms		<i>E.vermicularis</i>	
	%	prevalence	%	prevalence	%	prevalence
250	33	[13.2]	10	[4.0]	2	[0.8]

P = 0.005

Table 2: The prevalence of helminthic infections in relation to the gender of the subjects

Gender	No examined	<i>A. lumbricoides</i>		Hookworm		<i>Enterobius vermicularis</i>		Mixed infection	
		No +ve	% Prev	No +ve	% Prev	No +ve	% Prev	No +ve	% Prev
Male	114	10	8.8	4	3.5	2	1.8	1	1.75
Female	136	23	16.9	6	4.4	0	0.0	2	0.735
Total	250	33	13.2	10	4.0	2	0.8	3	1.2

P=0.043,

A. lumbricoides= *Ascaris lumbricoides*, No +ve = Number Positive, % Prev.= Percentage Prevalence

Table 3: The prevalence of helminthic infections in relation to the Age of the subjects

Age [years]	No examined	<i>Ascaris lumbricoides</i>		Hookworm		<i>Enterobium vermicularis</i>		Mixed infection	
		No +ve	% Prev	No +ve	% Prev	No +ve	% Prev	No +ve	% Prev
3-7	143	13	9.1	1	7.0	0	0.00	6	1.39
8-12	92	19	20.7	6	6.5	2	2.00	2	1.08
13-17	15	1	6.7	3	20.0	0	0.00	0	0.00
Total	250	33	13.2	10	4.0	2	0.8	8	3.2

P=0.028

KEY

No+ve = Number Positive, % Prev. = Percentage Prevalence

Table 4: The prevalence of mixed infections present in the study

Total examined	<i>A.lumbricoides</i> or Hookworms % prevalence	<i>A.lumbricoides</i> and <i>E.vermicularis</i> % prevalence	<i>E.vermicularis</i> and Hookworms % prevalence	Mixed infection % prevalence
250	5[2.0]	2[4.0]	1[0.8]	8[3.2]

P = 0.062

Table 5: The demographic status of the subjects.

S/N	Variables	Frequency [%]
I.	Parent occupation	
	Skilled	66[26.4]
	Unskilled	184[73.6]
II.	Toilet system	
	Indiscriminate defecation	175[70.0]
	Water closet	75[30.0]
III.	Use of footwear	
	Yes	209[83.6]
	No	41[16.4]
IV.	Nail nibbling	
	Trimmed nails	149[59.6]
	Long nails	101[40.4]
V.	Washing hands after defecation[hygiene]	
	Yes	84[33.6]
	No	166[66.4]

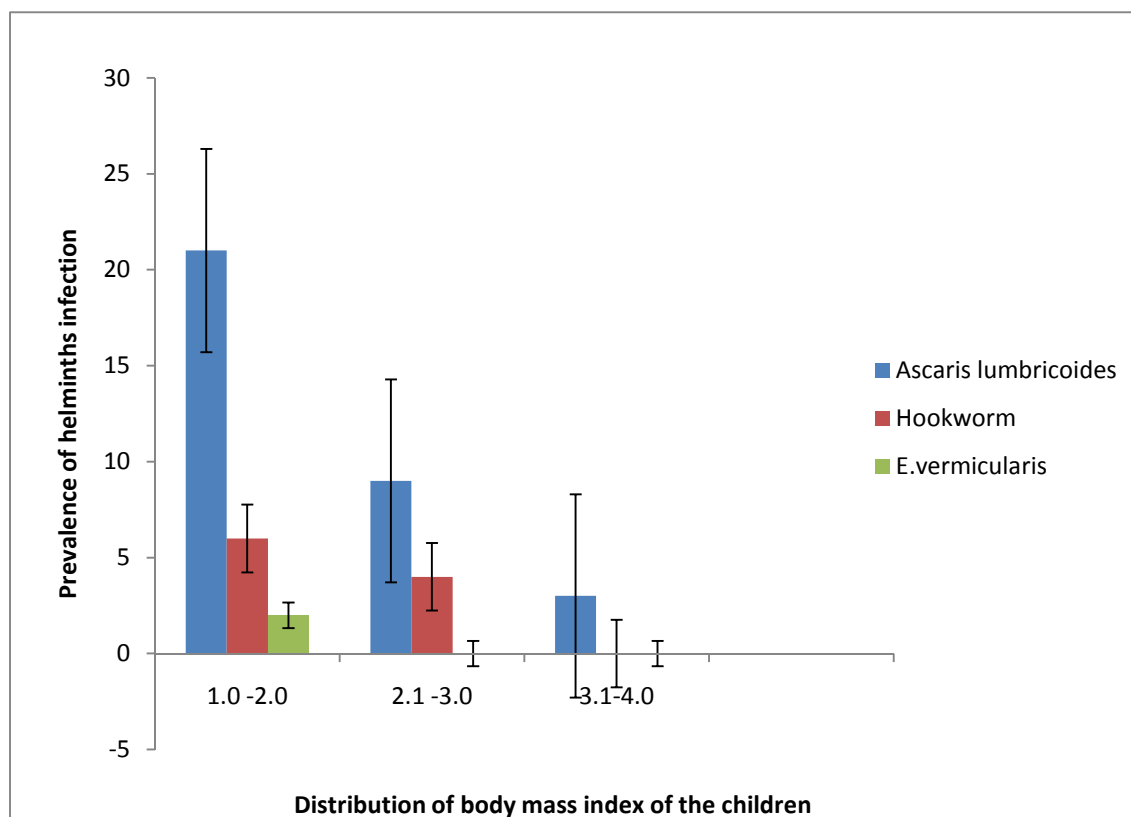
Table 6: Prevalence of soil transmitted helminthes in Owo Metropolis by socio-demographic characteristics

Category	Group	Urban			P value	Rural			P value
		No tested	No Positive	%		No tested	No Positive	%	
Sex	M	57	4	[7.0]	0.36	57	6	[10.5]	0.23
	F	70	10	[14.3]		66	13	[19.6]	
Age	3-7	73	5	[6.8]	0.93	70	8	[11.4]	0.48
	8-12	52	9	[17.3]		40	10	[25.0]	
	13-17	8	0	[0.0]		7	1	[14.3]	

M: Male F: Female

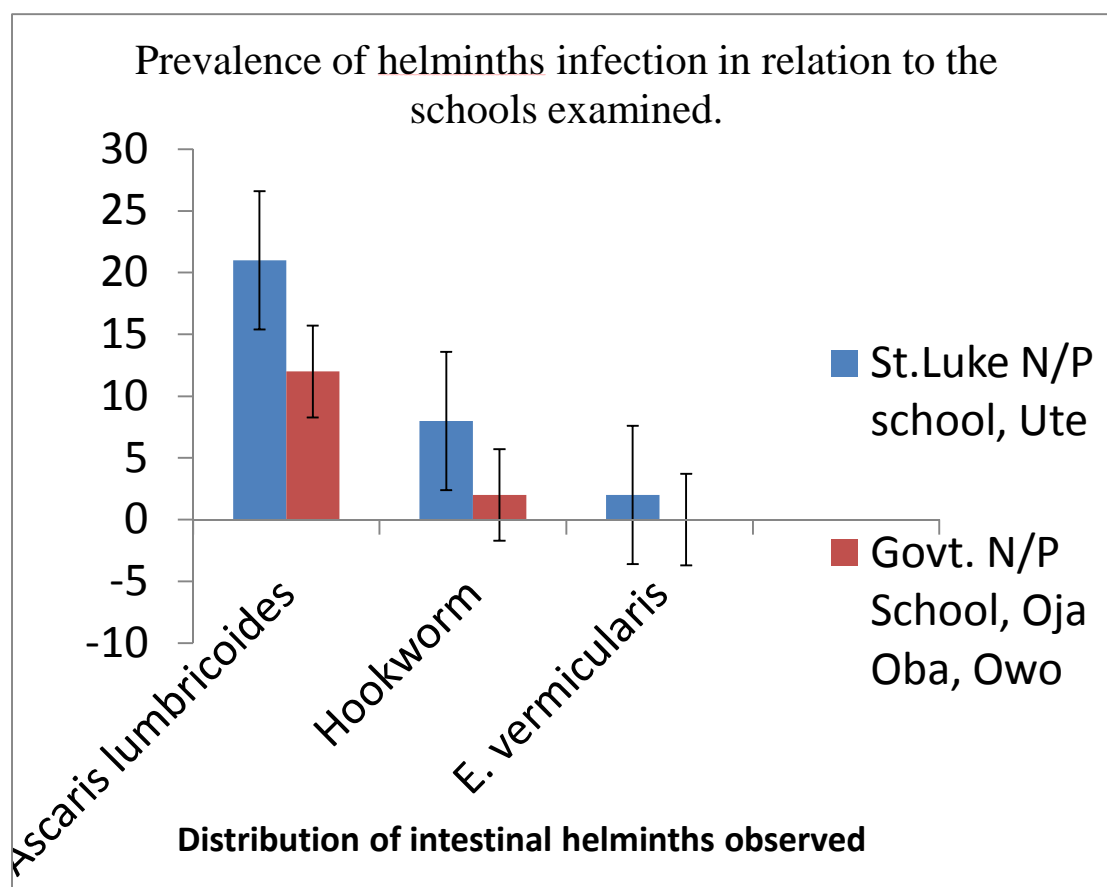
Table 7: Statistical significance soil transmitted helminthes in Owo Metropolis between and socio-economic status

Characteristics	Urban			P value	Rural			P value
	No tested	No Positive	%		No tested	No Positive	%	
Parent occupation								
Skilled	36	3	[8.3]	0.04	30	6	[0.2]	0.68
Unskilled	100	10	[1.0]		84	14	[16.7]	
Toilet system								
Indiscriminate defecation	100	9	[0.1]	0.57	75	13	[17.3]	0.64
Water closet	40	4	[0.1]		35	7	[0.2]	
Use of footwear								
Yes	108	11	[10.2]	0.05	101	14	[13.9]	0.00
No	21	2	[1.0]		20	6	[0.3]	
Nail nibbling								
Trimmed nails	80	7	[8.6]	0.05	69	11	[15.9]	0.06
Long nails	55	6	[10.9]		46	9	[19.6]	
Family size								
≤4	35	3	[8.6]	0.10	35	4	[11.4]	0.62
≥6	85	10	[11.8]		95	16	[16.8]	
Mother's Education								
Primary	60	7	[11.7]	0.22	80	11	[13.8]	0.43
High School	25	6	[24.0]		35	9	[25.7]	



P= 0.005

Figure 1: Distribution of body mass index in relation to the helminth infection



P= 0.000

Figure 2: Distribution of intestinal helminthes observed in relation to the school examined

DISCUSSION

Approximately half of the world's population in the tropics lives under the conditions that allowed transmission of parasitic diseases. The present study included a parasitological analysis of 250 stool samples and questionnaires in a tropical zone with low socioeconomic areas of south west Nigeria with special attention in geo helminthes. This study has documented a prevalence [13.2%] of soil transmitted helminthes in Owo metropolis.

The present survey investigated relationship between demographic data and helminthiasis in two primary schools in Owo local Government, Ondo State, Nigeria. This study revealed that was no statistical significant difference in the prevalence of soil transmitted helminthes between urban and rural students.

The study shows clearly that the burden of parasitic helminthes infections in school-children and poor sanitary conditions of the urban and rural schools owned by the government constitute a public health priority.

This study shows that *Ascaris lumbricoides* and *Ancylostoma duodenale* [hookworm] infections were likely more widespread in the study area than *Enterobius Vermicularis* infection. The higher prevalence of *Ascaris lumbricoides* than *Ancylostoma duodenale* [hookworm] agreed with some previous report^[21,22] but disagreed with previous studies conducted by Nwaorgu *et al.*^[23] There is higher prevalence of *Ascaris lumbricoides* compared to other worms encountered in this study. This is usual pattern reported by earlier studies and it might indicate high level of unhygenic practises amongst the pupils which enhanced transmission of the parasite.^[24-25] This is corroborated by the fact that 70% of the pupils

examined practise indiscriminate defecation while 59.6% indulge in fingernail nibbling.

Previous studies has reported that indiscriminate and open defecation can enhance the presence of intestinal helminth infection in the tropics.^[24,25,26] The absence of *Trichuris trichiura* infection in the study area was not expected because similar conditions generally influence its endemicity and that of *Ascaris lumbricoides* infection.^[25,26,27,28,29] It is likely that some false negative results were also recorded, or those having *Trichuris trichiura* infections were not enlisted in the study. Also, in the present study, the three intestinal helminthes recorded were not sex dependent. This is in conformity with some reports^[12,14,30,31,32] in similar settings. The prevalence of *Ascaris lumbricoides* infection suggests that the problems of unhygienic practises and low level of sanitation were not restricted to age group in the studied area. The demographic data indicated no significant difference between the incidence of geo helminthes in this locality, that is, urban and rural.^[33,34,35] This may be due to the fact that there were low level of health education about factors influencing transmission of soil transmitted helminthes the students, teachers and parents of pupils of the two schools. We observed no significant difference in the infection rate between urban and rural setting of Owo local government. The study also revealed a very high rate of unskilled job/ occupation among the parents in these communities. We equally observed that there was a relation between unskilled labour and incidence of geo-helminthes as more pupils whose parents were engaged in unskilled occupation tested positive for the parasites and a more significant correlation was observed in rural areas.^[34, 35] This was also factual for those pupils whose parents had a primary school level of education and where there was overcrowding in the study area. Rural males had a higher prevalence than their female counterparts, whereas in urban students females were more infected than males. There was no significant relation detected between the STHs infections and the age of the pupils in both urban and rural areas in Owo local government from data obtained in this study.

CONCLUSION

The prevalence of intestinal helminthiasis was higher in Government owned rural schools than in Government owned urban schools. The prevalence of these infections was associated with poor socio-economic status, poor hygienic habit and parental occupation. STHs are still currently been transmitted in Owo Metropolis by the outcome of the present study. The demographic data indicated no significant difference between the incidences of geo-helminthes in this locality.

RECOMMENDATION

Anti-intestinal helminth infection campaign should be conducted in the study area so as to reduce the prevalence of infection. Prompt control programmes against these parasitic infections should commence. There is a need for integrated periodical education and mass treatment with an antihelminthic drug to effectively control intestinal helminth in the study area.

The long term prevention and control of parasitic diseases will include economic development and improvements in water supplies, sanitation, health education and socio-economic status. Additional studies on control of parasitic diseases should be carried out and these should be coordinated with and integrated into epidemiological research so that the maximum benefits can be derived in the country. There is also a need for public health awareness programs, hygienic and adequate treatment of food to reduce the incidence of intestinal parasitic infections.

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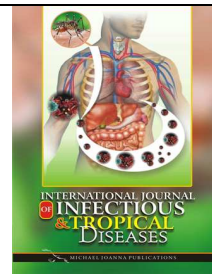
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