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PREVALENCE OF SOIL-TRANSMITTED HELMINTHS AMONG SCHOOL-AGE CHILDREN IN IFE EAST LOCAL GOVERNMENT AREA, OSUN STATE, NIGERIA

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ABSTRACT

Study on the prevalence of Soil-Transmitted Helminths (STHs) was carried out between August 2013 and March 2014 among pupils aged 4-17 years from five public primary schools in Ife East Local Government Area of Ile Ife, Osun State, Nigeria. Stool samples were collected from 395 pupils and examined for helminth eggs using modified Kato-Katz technique. Helmnth eggs were detected in 234 pupils (59.2%). Among the 186 males, 56.5%were positive while 61.7% of 209 females were infected although the difference in the rates between the two sexes was not significant (P>0.05). Eggs of three helminths, *Ascaris lumbricoides* (Linnaeus, 1758), *Trichuris trichiura* (Morgani, 1740) and hookworms (Dubini, 1838) were observed with prevalences of 44.8% 14.9% and 19.5% respectively. Prevalence of *A. lumbricoides* among the female pupils (46.5%) was not significantly different from prevalence among the males (42.5%) (P>0.05). Prevalence increased from 31.1% among the lowest age group 4-5 years to a peak of 50.5% in age group 8-9 years and decline to 31.3% at 13-14 years age group. There was no significant difference in prevalence by age among the pupils (P>0.05). Prevalences of *T. trichiura and* hookworms among the sexes were not statistically different (P>0.05). The mean intensities of *A. lumbricoides, T. trichiura* and hookworm were 4446.42±615.028, 232.89±59.831 and 309.08±58.029 Epg respectively however there were no statistical different with respect to sex and age among the pupils examined. Concurrent infection with two or all of the three worms were encountered in some of the pupils. The major predisposing factors to *A. lumbricoides* infections among the children were the pupils' parent's occupation, hand washing habit after visiting toilet and type of toilet used by the pupils.

Keywords: Soil-transmitted helminths, epidemiology, prevalence, *Ascaris lumbricoides*, Nigeria.

INTRODUCTION

Soil-Transmitted Helminthes (STHs) are intestinal worms in which their immature stages require a period of development or incubation in the soil before they become infective (Chukwuma *et al*., 2009). The commonest and well known of such parasites are *Ascaris lumbricoides* (Linnaeus, 1758), *Trichuris trichiura* (Morgani, 1740), hookworms (Dubini, 1838) and *Strongyloides stercoralis* (Bavay, 1876) (Cheesbrough, 2000). According to the United Nations Convention on the Rights of the Child (1990), a child is defined as "a human being below the age of 18 years." Studies have shown that the most vulnerable group to STHs are children. In Nigeria, more than 90% of this age group are either in preschool, primary or secondary school. It is estimated that over one billion people are infected with *A. lumbricoides*, 800 million with hookworms and 770 million with *T. trichiura* (Ogbe *et al*., 2002). STHs are usually more prevalent among pre-school and school-aged children worldwide. They are identified as a cause of morbidity and mortality

in humans throughout the world particularly in the developing countries within the tropical and sub-tropical countries (Awolaju and Morenikeji, 2009). The transmission of soil-transmitted helminths depends on environment contaminated with egg-carrying feaces. Consequently, infection with these helminthes are intimately associated with poverty, poor sanitation, inadequate healthcare, poor education, lack of clean water and inadequate personal hygiene (Crompton, 1989; Asaolu *et al.*, 2002). Although STH infections occur predominantly in rural areas, the social and environmental condition in many unplanned slums and scattered settlements of developing countries are ideal for persistence of *A. lumbricoides* (Crompton and Savioli, 1993). These infections affect most frequently children in endemic countries and are associated with poor growth, reduced physical activities and impaired learning abilities (Stephenson *et al.*, 1990; Nokes *et al.*, 1992; Adams *et al.*, 1994; Koroma *et al.*, 1996; Stollzfus *et al.*, 1996). According to WHO (1998), the morbidity associated with these helminths infections include a wide range of abdominal complications, iron-deficiency anaemia and dysentery syndrome.

In Nigeria, there has been no national school based parasites or soil-transmitted helminthes control programmes (Odu *et al*., 2011). Also, there are no available data about the demography and hygienic conditions of the children in most schools to help guide the development of school health programmes which are required for sustainable control of soil-transmitted helminths in school children. In the past, there have been sporadic and uncoordinated de-worming programs undertaken by government officials without any baseline information or data (Ekpo *et al*., 2008). Therefore, there is the need to have accurate, comprehensive, valid, and reliably documented information about the epidemiology, distribution and complication on parasitic diseases among the school children in the country. Although a number of studies have been conducted on these parasitic diseases in Nigeria (Ofoezie *et al*, 1996, Ugbomoiko and Ofoezie, 2006), many areas remain unstudied and information on co-occurrence and risk factors of these parasitic diseases necessary for integrated strategy in most rural areas are scanty. Furthermore, there appears to have been no previous report on the status of soil-transmitted helminthiases in Ife East Local Government Area (LGA) of Osun State, Nigeria. Therefore this study was undertaken to carry out epidemiological survey of these helminthes in the area from August 2013 to March 2014.

MATERIALS AND METHODS

Study Area

The study area is located in Oke Ogbo, Ife East Local Government of Osun State, Nigeria within latitudes 07826^0N–07833^0N and longitudes 004830^0E– 004835^0E. The climate of the area is typically tropical, with a characteristic dry season of about 5 months (November– March) and a wet season of about 7 months (April–October) (Akinbuwa and Adeniyi, 1996). The vegetation of the area is tropical rainforest, characterized by large and tall trees (Sowemimo, 2007). The inhabitants are predominantly Yoruba speaking people of the Southwest with a mixture of people from different ethnic groups in Nigeria. Farming is the main occupation of the people but some are traders, transport workers, artisans and civil servants.

Consent and Ethical Issues

Prior to the commencement of the study, permission was obtained from Local Inspector of Education (L.I.E) in Ife East Local Government. Schools Heads and Class Teachers of the selected schools were contacted and the parents and pupils were adequately enlightened on the purpose of the study. Informed consent was obtained from each pupil and their parents and any child that did not want to participate was allowed to opt out.

Questionnaire Administration

A well-structured and pre-tested questionnaire was administered to collect socio-demographic information on each pupil in their local language and their responses were recorded by ticking the appropriate boxes provided. The information contained in the questionnaire include pupils' bio-data, parents' educational background and pupils' sanitation. The student's footwear as well as their fingernails were also inspected

Study Subjects

The studied persons were primary school children aged from 4-17 years. The five public primary schools used for this study were chosen by randomization technique (Adanyi *et al.*, 2011). The names of public primary schools in the study area were collected from the L.I.E, Ife East Local Government Area. The name of each of the ten schools provided was written on a separate piece of paper. The ten pieces of paper were then placed in a bag and properly shaken and five were then picked at random. The five schools whose names were picked are Christ Apostolic Church Primary School A, Moore, Christ Apostolic Church Primary School B, Moore, Idita Community Primary School Idita, Saint Paul's Primary School Ayegbaju and Christ Apostolic Church Primary School A, Iloro.

Collection of Stool Samples

Stool samples were collected from all the willing pupils in each school. The samples were collected between 10.00am and 1.00pm when most of the pupils were in attendance in the schools. All participating pupils were supplied with a clean labeled plastic universal bottle with screw cap, a clean sheet of paper and a wooden spatula each. The children were instructed to pass their faeces on the sheet of paper provided and to use the wooden spatula to transfer enough of the feaces to fill half of the bottle and then to cover the bottle tightly with screw cap. The used papers were discarded by burning off. Faecal samples collected were fixed immediately by adding adequate 10% formalin and mixed thoroughly with a wooden applicator stick (Salawu *et al.,* 2014). The samples were taken to the Department of Zoology, Obafemi Awolowo University Laboratory where they were processed using modified Kato-Katz technique (WHO, 1994) and examined for helminths ova.

Laboratory examination of faecal sample

Each of the preserved faecal samples was first strained through two double-ply cotton gauze. The faeces was washed several times with distilled water to ensure higher recovery of helminths eggs. The filtrate was centrifuged at 2,500 rpm for 5 minutes. The supernatant was decanted leaving the sediment. A plastic template with a central hole 6mm in diameter was placed on a clean glass slide and the hole filled with stool sediment. The template was carefully withdrawn from the slide leaving the faecal sample of about 14.7mg on the glass slide. Two drops of malachite green solution was added to the sample on the slide and then mixed thoroughly. The mixture was covered with a cover slip and then examined under a light microscope for helminths eggs. Each morphologically different eggs was counted using a tally hand counter. The intensity of each helminth observed was determined by multiplying the number of eggs of the species counted by 24 to obtain the number of eggs per gram of faeces (Epg) (WHO, 1991).

Statistical analysis

All statistical analyses were performed using SPSS for windows version 16.0. Differences in prevalence and intensity of infection were tested by chi-square, t- test and one way ANOVA. Statistical difference was assigned at $P \leq 0.05$. Bivariate logistic regression was further carried out to assess the predictive effect of the various variable measure on the prevalence of all the three helminths in this study.

RESULTS

Soil-transmitted helminths infections among the pupils

A total of 395 pupils submitted their faecal samples for examination from the five schools studied. The pupils consisted of 186 (47.1%) males and 209 (52.9%) females. The number of pupils seen in each of the five schools in relation to gender is shown in Table 1. A total of 234 (59.2%) stool samples were positive for helminth eggs. Prevalence among the males (47.1%) was not significantly different from the females (52.9%) ($P>0.05$). The eggs of soil-transmitted helminths observed in the feacal samples were those of *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms with prevalences of 44.8%, 14.9% and 19.5% respectively.

Soil-transmitted helminths infections among the pupils in different schools

The prevalences of infection observed for each of the worm in the children in each of the five schools are indicated in Table 2. Prevalence of *A. lumbricoides, T. trichiura* and hookworms varied among the five schools but their lowest prevalences (22.7%, 1.5% and 1.5%) were

recorded among pupils of St. Paul's Primary School, Ayegbaju and there was significant difference among the schools with respect to the three helminths ova ($P<0.05$). The highest prevalence (50.7%) of *A. lumbricoides* was recorded among pupils of C. A. C. Primary School B, Moore, while the highest prevalence of hookworms and *T. trichiura* (32.6% and 23.2% respectively) were recorded among pupils of C. A. C. Primary School A, Moore and the differences were statistically significant among the schools ($P<0.05$).

Prevalence of Soil-transmitted helminths infections among the pupils with respect to age and sex

The prevalence of infection with *A. lumbricoides* among the 395 pupils was 44.8%. Prevalence among males and females were very close and showed no significant difference ($P>0.05$) (Table 3). Prevalence varied among different age groups with the lowest among the lowest age group 4-5 years (31.1%) rising to a peak in age group 8-9 years (50.5%) before declining in age group 16-17 years. ($P>0.05$) (Table 4). The prevalence of hookworms among all the pupils was 19.5% with the males having higher prevalence (22.0%) than their female counterparts (17.2%) ($P>0.05$). The prevalence of infection of *T. trichiura* among the pupils (14.9%) was lower than prevalences of *A. lumbricoides* and hookworms. Prevalence of *T. trichiura* was lower among the male children (12.4%) than the females (17.2%) and the difference was not statistically significant. Prevalence of *T. trichiura* rose from 4.4% among age group 4-5 years to a peak 20.3% in age group 10-11 years and fell gradually thereafter to 6.3% in age group 16-17 years ($P<0.05$).

Intensity of infection among the pupils with respect to age and sex

Table 3 shows the mean intensity of infection for *A. lumbricoides* among the 395 pupils was 4446.42±615.028Epg. Intensity was not significantly higher among the males (5429.27±1140.026 Epg) than the females (3576.43±567.355 Epg) ($P>0.05$). Except for the age group 6-7 years where the intensity showed an increase to 7491.88Epg. The intensity made a gradual rise from the lowest value of 1995.22±760.103 observed among the age group 4-5years to 4705.88± 2181.077 in age group 14-15years and then decline to 2464.44±1401.488 among the oldest age group 16-17years. There was no significant difference between intensity of *A. lumbricoides* among the age groups ($P>0.05$) (Fig 1)

The mean epg for hookworms among the 395 pupils was 309.08 ± 58.029. The intensity of infection among the two sexes was not statistically significant ($P>0.05$) (Table 3). The intensity of hookworms infection did not show a regular trend with respect to age of pupils as the highest intensity (482.10±185.668 Epg) was recorded among age group 8-9 years while the lowest intensity (119.11 ± 47.220Epg) was observed among age group 6-7 years. There was no significant difference between intensity of hookworms among the age groups ($P>0.05$) (Fig 2). The mean epg for *T. trichiura* for all the samples was 232.89 ±59.831. Intensity among males (168.24±53.562Epg) was not significantly lower than females (290.11±102.327Epg) pupils. ($P>0.05$). (Table 3). *T. trichiura* intensity was lowest (32.67± 22.979 Epg) among the age group 4-5 years and rose to the highest 341.59± 188.329Epg in age group 8-9years and then decline steeply to 150.09±64.500Epg among 16-17 years (Fig 2). There was no significant difference between the intensity of *T. trichiura* among the age groups ($P>0.05$)

Prevalence of Multiple infections of soil transmitted helminths among the pupils

Faecal samples from seventy five (19.0%) of the pupils were observed to contain eggs of two or three different helminths. Table 5 shows, 11.4% of the pupils harbour both *A. lumbricoides* and hookworms, 8.4% harbour *A. lumbricoides* and *T. trichiura*, 5.6% harbour hookworms and *T. trichiura* while 2.8% of the pupils harbour the three parasites concurrently. Although gender related multiple infections showed no significant difference, females have higher prevalences than their male counterparts in all the multiple infection categories. Among the different age groups, the oldest age group 16-17 years had the least occurrence of multiple infections while age group 7-8 years had the highest. There was a significant difference among the age groups with respect to multiple infections among the pupils $P<0.05$. (Table 6)

Risk factor pre-disposing children to STH infection

The risk factors analysis (Table 7) showed that the odds of being infected with *A. lumbricoides* is more likely among pupils whose parents were farmers. Pupils whose parents were farmers and artisans were 3.0 and 1.5 times more likely to be infected with *A. lumbricoides* than pupils whose parents were civil servants. The risk factor also showed that pupils that made use of water closet and latrine were 0.2 and 0.5 times respectively less likely to be infected with *A. lumbricoides* than pupils that made use of open defeacation. According to the hand washing habit after visiting a toilet, the odd of being infected with *A. lumbricoides* was observed to be 0.6times less likely in pupils that always washes their hands and 2.2 times more likely among those that do not wash their hands than those that washes their hands sometimes after each visit to the toilet.

Table 1. Number of children examined in each of the schools in relation to gender

Schools	Male	Female
1. C. A. C. Pry. Sch. A Moore	47	48
2. C.A.C. Pry. Sch. B Moore	35	40
3. Idita Comm. Pry.Sch.	42	44
4. St Paul's Pry. Sch. Ayegbaju	30	36
5. C.A.C. Pry. Sch. A Iloro	32	41
Total	186	209

Table 2. Prevalence of soil-transmitted helminths among pupils according to schools

S/N	Schools	No examined	% +ve for helminth eggs		
			A. lumbricoides n(%)	Hookworms n(%)	*T. trichiura* n(%)
1.	C. A. C. Pry. Sch. A Moore	95	46 (48.4)	31(32.6)	22(23.2)
2.	C. A. C. Pry. Sch. B Moore	75	38 (50.7)	9(12.0)	15(20.0)
3.	Idita Comm. Pry Sch Idita	86	39 (45.3)	16 (18.6)	8 (9.3)
4.	St Paul's Pry. Sch. Ayegbaju	66	15 (22.7)	1 (1.5)	1(1.5)
5.	C. A. C. Pry. Sch. A Iloro	73	39 (53.4)	20 (27.4)	13(17.8)
	Total	395	177(44.8)	77(19.5)	59(14.9)
	P value		$P < 0.05$	$P < 0.05$	$P < 0.05$

Table 3. Prevalence and intensity (Epg ± SE) of Soil-Transmitted Helminths (STH) in relation to sex

Sex	No Examined	*A. lumbricoides* No. (%)infected	Epg ± SE	Hookworms No. (%) infected	Epg ± SE	*T. trichiura* No. (%) infected	Epg ± SE
Male	186	79(42.5)	5429.27±1140.02	41(22.0)	267.48±54.711	23(12.4)	168.24±53.562
Female	209	98(46.9)	3576.43±567.355	36(17.2)	346.10±98.345	36(17.2)	290.11±102.327
Total	395	177(29.5)	4446.42±615.028	77(19.5)	309.08±58.029	59(14.9)	232.89 ±59.831
P value		P>0.05		P>0.05		P>0.05	

Table 4. Prevalence of Soil Transmitted Helminthes (STH) with respect to Age group of pupils

Age (yrs)	No examined	*A. lumbricoides* No. (%) infected	Hookworms No. (%) infected	*T. trichiura* No. (%) infected
4-5	45	14(31.1)	3(6.7)	2(4.4)
6-7	81	36(44.4)	11(13.6)	11(13.6)
8-9	103	52(50.5)	22(21.4)	18(17.5)
10-11	79	39(49.4)	20(25.3)	16(20.3)
12-13	46	19(41.3)	10(21.7)	8(17.4)
14-15	25	12 (48.0)	7(28.0)	3(12.7)
16-17	16	5(31.1)	4(25.0)	1(6.3)
Total	395	177(19.5%)	77(19.5%)	59(14.9%)
	P value	P< 0.05	P>0.05	P< 0.05

Table 5. Prevalence of Multiple infection of soil transmitted helminthes in relation to sex among pupils

	Male	Female	Total
Parasite	No. (%) infected	No. (%) infected	No. (%) infected
A. lumbricoides + Hookworm	23(12.4)	22(10.5)	45(11.4)
A. lumbricoides + *T. trichuira*	17(9.1)	16(7.7)	33(8.4)
Hookworm + *T. trichuira*	11(5.9)	11(5.3)	22(5.6)
A.lumbricoides+Hookworm+ *T.trichuira*	8(4.3)	3(1.4)	11(2.8)

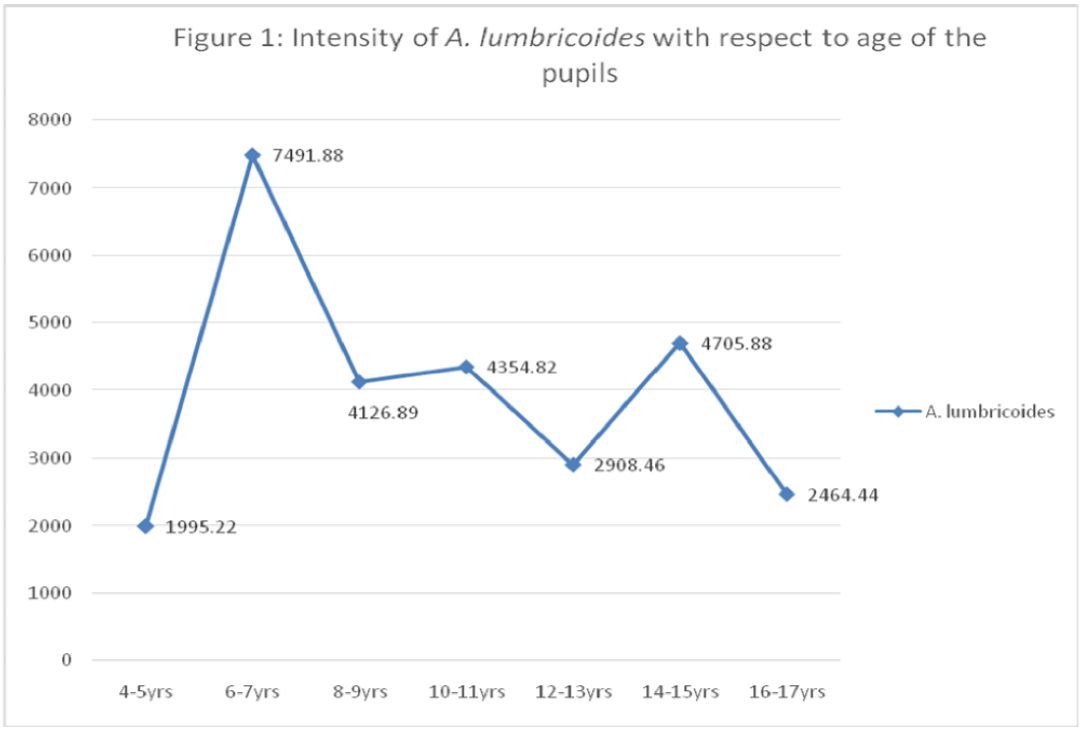
Table 6. Prevalence of Multiple infections of Soil-Transmitted Helminths in children in relation to age groups

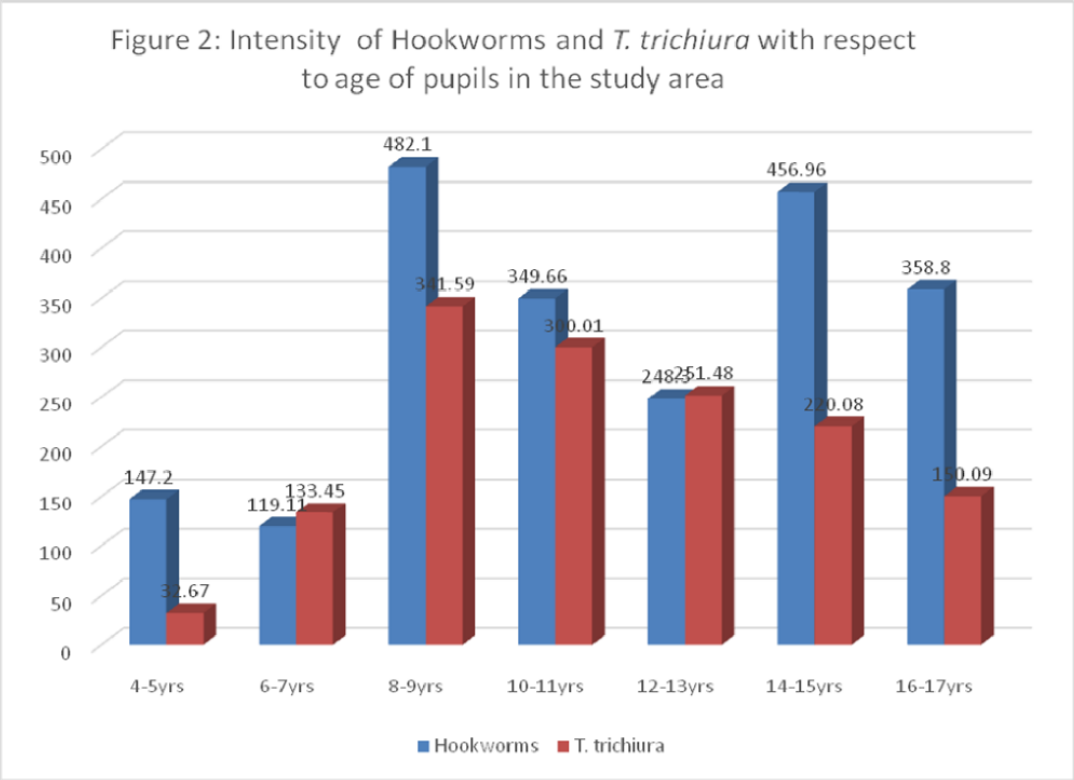
Age group (yrs)	*A. lumbricoides* + Hookworm No. (%) infected	*A. lumbricoides* + *T. trichuira* No. (%) infected	Hookworm + *T. trichuira* No. (%) infected	*A. lumbricoides*+ Hookworm+ *T.trichiura* No. (%) infected
3-4	3(6.7)	1(2.2)	0(0.0)	0(0.0)
5-6	6 (7.4)	7 (8.6)	4(4.9)	4(4.9)
7-8	12(11.7)	11(10.7)	8(7.8)	3(2.9)
9-10	12(15.2)	8(10.1)	7(8.9)	3(3.8)
11-12	8(17.4)	4(8.7)	3(6.5)	1(2.2)
13-14	3(12.0)	2(8.0)	0(0.0)	0 (0.0)
15-16	1(6.3)	0(0.0)	0(0.0)	11(2.8)
Total	45(11.4)	33(8.4)	22(5.6)	11(2.8)
P value	P<0.05	P<0.05	P<0.05	P<0.05

Table 7: Result of Logistic Regression analysis showing the effect of parent occupation, toilet type and type of domestic animal kept on the prevalence of *A. lumbricoides* in the study area.

Parameter[a]	No. Examined	Odds ratio (95% CL)	P Value
Parent's occupation			
Farmer	58	3.00 (1.01 – 8.33)	0.05
Artisan	124	1.50 (0.65 – 3.45)	0.34
Trader	105	0.87 (0.40 – 2.00)	0.75
Civil servant[b]	43		
Toilet type			
Water closet	18	0.21 (0.04 – 1.07)	0.06
Latrine	63	0.45 (0.10- 2.12)	0.31
Open defecation[b]	249		
Hand washing habit after visiting toilet			
Do wash always	243	0.64 (0.34- 1.21)	0.16
Do not wash	104	2.16 (0.94 -5.00)	0.07
Do wash sometimes [b]	48		

95% CL, 95% Confidence Limit
[a]Variables
[b]Reference group.





DISCUSSION

The occurrences of soil transmitted helminthiasis due to the triad of *A. lumbricoides*, hookworms and *T. trichiura* as observed is this study has been reported in children by various authors from different parts of the world (Nwosu, 1981; Asaolu *et al*., 2002; Egwunyenga and Ataikiru, 2005; Ugbomoiko *et al*., 2006; Adeoye *et al*., 2007 and Sowemimo and Asaolu, 2011). The occurrence of *A. lumbricoides* infection in all the age groups highlighted in this study is similar to the situation in several other communities in Nigeria (Sam-wobo and Mafiana, 2004; Agbolade *et al*., 2004; Ugbomoiko *et al*., 2006). However lower prevalences of *A. lumbricoides* of 15.0% (Aisien *et al*., 2002); 18.8% (Akogun and Badaki, 1998) and 13.1% (Asaolu *et al*., 2002) were reported in Edo, Adamawa and Osun States respectively. The trend in the prevalence of *A. lumbricoides* among the age groups in this study is in line with the observation of Sowemimo and Asaolu (2011) in a study conducted among pre-school and school aged children in Ile- Ife Osun State. The authors observed that the lowest prevalence of helminths infections were recorded among lower age groups while the highest prevalence were recorded in children aged 10 years and above. The high prevalence in these older age groups could be attributed to the fact that children at this age are not mindful of the health risk that is associated with playing in contaminated environment and they often spend their leisure time playing out-door while the younger ones are relatively more protected by their parents. They are often in contact with soil and are found eating indiscriminately with unwashed hands. The low prevalence in age 16-17years could be attributed to the fact that as a child gets older; the child tends to be more cautious of hygienic habits and may not always get involved in playing in dirty environment (Adanyi *et al*., 2011).

From the study, it is observed that prevalence of hookworms and *T. trichuira* with respect to age of the pupils follow same trend with low prevalences observed among the older age groups. This agrees with the report of Celia *et al*. (1989) which explained that the observation might be related to behavioural differences

which influence the degree of contact with infective ova in the environment.

The worm with the highest mono-infection in this study was *A. lumbricoides*, followed by hookworms while mono-infection with *T. trichiura* was the least. The finding of this study is in accordance with the findings of Ibidapo and Okwa (2008) and Nmorsi *et al*, (2009) in Lagos and Delta States respectively.

The most common combination of intestinal helminths is *Ascaris* and hookworms which agrees with the works of Onuoha *et al*. (2010) and Alli *et al*. (2011) among school children in Enugu and Oyo States respectively but differs from the report of Oyewole *et al*. (2002) who observed high prevalence in co-infection among *Ascaris* and *T. trichiura* in Ondo State, Nigeria.

The type of toilet used was significantly associated with the prevalence of *A. lumbricoides* and was retained as a significant risk factor in the logistic regression model. Pupils who made used of open defeacation were highly susceptible to *A. lumbricodes* infection more than others. The reason for the practice of open field defecation by some of the respondents could be due to poverty and lack of means to construct a latrine or water closet toilets. The result is similar to the findings of Adanyi *et al*. (2011) among 1204 primary school children in Kaduna State. The parental socio-economic status is another important variable determining risk factor predisposing pupils to *A. lumbricoides* infection. From logistic regression analysis the odds of being infected by pupils whose parents were farmer was 3.0 times more likely than pupils whose parents were civil servant. Simply explanation for this could be the fact that farmers were exposed to contaminated soil especially those that use night soil as fertilizer for crops. This result is in conformity with the report of Kirwan *et al*. (2009) who reported that children of farmers usually harbour higher load of *A. lumbricoides* than those whose parents were businessmen or professionals. Also logistic regression model showed that indiscriminate open defeacation was significantly associated with the prevalence of *A. lumbricoides* infection. The open field used by pupils is often carpeted with dry and fresh human waste thereby increasing the risk of infection. Improper disposal of human wastes has been associated with infections of intestinal helminths in other countries thereby indicating that members of the public are at risk of infection with these helminths especially where open field defecation is commonly practiced. Hand washing habit after visiting toilet is another risk factor predisposing pupils to *A. lumbricoides* infection. It was observed that the odds of being infected with *A. lumbricoides* by pupils who do not wash their hands after visiting toilet is 2.2 times more likely than those that washes their hands sometimes after each visit to toilet. According to Ogbaini-Emovon *et al*. (2014) who reported that poor environmental and personal hygiene with respect to disposal of human faeces and hand washing after defecation and before eating are the driving forces of STH infection. Therefore, lack of personal hygiene and proper hand washing habit were some of the factors that predisposes children to soil transmitted helminthes infection.

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