academicJournals

Vol. 7(45), pp. 5148-5153, 14 November, 2013
DOI: 10.5897/AJMR2013.6258
ISSN 1996-0808 ©2013 Academic Journals
http://www.academicjournals.org/AJMR

African Journal of Microbiology Research

Full Length Research Paper

Soil-transmitted helminth infections among school children in rural communities of Moro Local Government Area, Kwara State, Nigeria

Babatunde, Shola Kola[1]*, Adedayo, Majekodunmi Racheal[1], Ajiboye, Adeyinka Elizabeth[1], Sunday, Ojo[2] and Ameen, Nimat[3]

[1]Microbiology Unit, Department of Biosciences and Biotechnology, College of Pure and Applied Sciences, Kwara State University, Malete, Kwara State, Nigeria.
[2]Zoology Unit, Department of Biosciences and Biotechnology, College of Pure and Applied Sciences, Kwara State University, Malete, Kwara State, Nigeria.
[3]University Clinic, Kwara State Univesity, Malete, Kwara State, Nigeria.

Accepted 21 October, 2013

We investigated stool samples of primary school pupils in four rural communities of Moro Local Government Area of Kwara State for helminthic intestinal parasites and its intensity. Four hundred and thirteen (413) pupils submitted their samples for examination. The samples were examined by wet preparation, formol ether concentration methods and Stoll's technique to estimate the worm burden of positive stool samples. Overall prevalence of soil transmitted helminths (STH) in the four communities was 41.9%. The ova/larvae of STH parasites detected were hookworm, *Ascaris lumbricoides, Trichuris trichiura* and *Strongyloides stercoralis* with prevalence of 15.4, 11.3, 8.1 and 7.1%, respectively. Generally, the intensity of parasitic infections among the pupils was moderate. STH infection was more in 15-20 years age groups than those of 5-9 years and 10-14 years. Risk factors that contributed to high prevalence of STH infections among the pupils and methods of control were discussed.

Key words: Soil-transmitted helminths, parasitic intensity, Moro Local Government Area, school pupils, risk factors.

INTRODUCTION

Soil-transmitted helminths (STH) infections are among the most common infections worldwide and affect the poor and deprived communities. The four main soil-transmitted helminth infections are ascariasis, trichuriasis, hookworm and strongyloidiasis caused by *Ascaris lumbricoides, Trichuris trichiura*, *Ancylostoma duodenale/Nector americanus* (hookworm) and *Strongyloides stercoralis*, respectively. Recent estimate suggests that *A. lumbricoides* infects over one billion people, *T. trichiura* 795 million and hookworm 740 million (WHO, 2013). Generally, more than 1.5 billion people or over 24% of the world's population are infected with these infections worldwide (WHO, 2013). Sub-Saharan Africa has the highest prevalence of these helminth parasites than Latin-America, Caribbean, Middle-east and North Africa (WHO, 2013; Murry and Lopez, 1996; Chan et al., 1994).

Adult hookworm inhabit the upper part of the human small intestine, while *Ascaris lumbricoides* parasitize the entire small intestine and adult *Trichuris trichiura* lives in the large intestine of the human gastrointestinal tract (Bethany et al., 2006).

*Corresponding author. E-mail: solakemibab@yahoo.com, sholakemibabatunde@gmail.com. Tel: +2348035035590.

STH infections are widely distributed throughout the tropics and subtropics, where climatic conditions are very important determinant in transmission of these infections (Bethany et al., 2006). Adequate moisture and warm temperature are essential for larval development in the soil (de Silva et al., 2003; Brooker and Micheal, 2000). Other important determinants in epidemiology of soil-transmitted helminths are poverty, inadequate water supply, sanitation and poor personal hygiene especially shoe wearing and hand washing (de Silva et al., 2003). Those conditions favour soil-transmitted helminth species and infection commonly occurs as co-infection. STH infections have profound effect on health of growing children, such as chronic ill health and insidious clinical presentation (Brooker and Micheal, 2000). Such children are mal-nourished, have stunted growth, intellectual retardation, anaemia and poor school attendance. Morbidity from these infections and rate of transmission are directly related to the number of worms harboured in the host (Anderson and May, 1991). The intensity of infection is the main epidemiologic index used to determine level of soil-transmitted infection.

Malete, Elemere, Ore-Olumoh and Animaje are small rural communities of Moro Local Government of the central senatorial district of Kwara State. Most of the inhabitants of these villages are farmers, hunters and traders. The water supply is mainly through boreholes, while others depend on locally dug wells, streams/rivers and ponds. Most dug wells dried during dry season (between November and March) then villagers use streams/rivers or ponds as sources of their domestic water supply.

There is continual need to call the attention of the world to the burden of STH infections, some of which are among the neglected tropical diseases. The total burden of diseases due to STH infections and its consequences could be prevented in high-prevalence communities by massive de-worming of school age children (WHO, 2013). Knowledge of the distribution and extent of intestinal helminth infections in rural communities is thus a prerequisite for planning and for effective treatment. There has been no previous report on epidemiology of STH infections in these communities. This survey assessed the prevalence and intensity of soil-transmitted helminth in school age children of rural communities and conditions that might influence their transmission.

MATERIALS AND METHODS

Study site

The study was carried out among the pupils of ages 5-20 years in primary schools at Malete, Elemere, Ore-Olumoh and Animaje rural communities of Moro Local Government area of Kwara State, Nigeria. Kwara State is within the middle belt region of Nigeria and is the link state between the Northern and the Western parts of Nigeria. I t is within the Savannah region and the climate is of equatorial type with rainy and dry seasons. The annual rainfall ranges from 1,000 to 1500 mm. The minimum temperature range is 24-32°C while mean the maximum range is 35-38°C (Kwara State Today, 1997). The communities' water sources were traditionally dug wells, boreholes usually provided by government or its agencies, while nature sources are stream/river and ponds.

Study population

The study population consisted of registered primary school children because they form most accessible age group and most vulnerable to STH infection community. A questionnaire survey data from the pupils included age, type of toilet available, sex, hand washing habit, water sources, weight and occupation of parents or guardians. Ethical approval for the study was granted by the Kwara State University, Malete. Further clearance was obtained from local government health board. Oral consent was obtained from the village heads, clan heads and parents, in addition head and school teachers. Those who refused to give consent were excluded from the study.

Sample collection

All pupils that have consented to the study were enrolled by collection of their survey biodata within the months of February to May, 2013. Children that have received anti-helminthic drugs (randomly and infrequently distributed by State and Local Government Authority) within the past three months in all the schools were excluded from the study. A labelled sterile universal plastic bottle with pupil's name and serial number from the register of biodata was given to each pupil. They were then given sample collection instruction that was done in the local language of the pupils for understanding. These samples were taken to the laboratory as soon as received, usually less than two hours after collection in a carton.

Sample examination

Macroscopic examination was done on each sample as soon as they reached the laboratory. This was used to assess the diarrhoeic condition of the sample. Particular attention was paid to watery, loose or formed stools including presence of mucus and blood in stool. Wet preparation of each sample was done using normal saline and examined immediately.

Ridley modified formol ether concentration technique (Cheesbrough, 1987) was used to improve on the recovery of the ova and larvae of helminth parasites from the samples that were missed in wet preparation. The sediments were examined by placing one drop each on the centre of the slide covered with cover-slip and they were examined, parasites were identified as previously described (WHO, 2004). The eggs and larvae count was done in formol ether concentration technique by weighing 1 g faeces. The entire preparation was examined and eggs found were counted, which gave the number of eggs per gram of faeces. Chi-square test was used to compare the data, P value less than 0.05 was considered significant using SPSS package.

RESULTS

The villages were Malete, Elemere, Ore-Olumoh and Animaje with samples population size of 156 (males 81, female 75); 115 (males 47, females 68); 75 (males 38, females 37) and 67 (males 31, females 36) respectively.

Table 1. Prevalence of intestinal STH infection in rural communities of Moro LGA.

Organism	Male (%)	Female (%)	Total No (%)
A. lumbricoides	19 (4.7)	27 (6.6)	46 (11.3)
Hookworm	36 (8.8)	27 (6.6)	63 (15.4)
T. trichiura	17 (4.2)	16 (3.9)	33 (8.1)
S. stercoralis	12 (2.9)	17 (4.2)	29 (7.1)
Overall Prevalence	84 (20.6)	87 (21.3)	171 (41.9)

Excluded pupils due to use of drug and non-consent were less than 10 pupils from each village.

In these rural areas, we detected intestinal helminths in 171 (41.9%) of 413 specimens, distributed as follows: Malete 115 (73.7%), Elemere 86 (74.8%), Ore-olumoh 70 (92.1%) and Animaje 50 (74.6%). The overall distribution of the STH parasites among the pupils of the rural communities is shown in Table 1.

Hookworm parasite (15.3%) was the most frequently detected STH parasites, while *S. stercoralis* (7.1%) occurred least. Overall sex distribution showed that female pupils (21.3%) were slightly more infected with STH parasites than the male pupils (20.6%).

Table 2 shows that there were 197 (47.7%) male pupils that registered for this study, 84 (42.6%) of which had at least one helminth parasite in their stool sample, while out of 216 (52.3%) of the female pupils registered for the study, 87 (40.3%) had at least one parasite detected.

The pupils were grouped into three categories based on their age: 5-9 years (43.3%), 10-14 years (52.5%) and 15-20 years (4.1%). Age group 15-20 years had the higher prevalence of helminth parasite of 47.1% than age groups five to nine years (41.9%) and 10-14 years (39.6%). There were fewer pupils in age group 15-20 years because most of their mates have gone to high school or gone to learn trade or apprenticeship.

The education system is divided into first basic primary school, that is, Primary 1-3 with 213 (51.6%) pupils and second basic primary school that is, primary 4-6 with 200 (48.4%) pupils. Pupils in first basic primary school had a higher prevalence of 42.7% of helminth infection than 40.0% of second basic primary school. Age distribution is presented in Table 2.

There were three main sources of domestic water supply to these communities where the pupils lived: bore hole, locally dogged well and stream/river. Parasites were found at higher frequency in pupils that use well (54.1%), than river/stream, 47.1% and bore hole, 38.6%. However, the difference was not significant at $P > 0.05$.

Most homes in these communities do not have toilet facilities. Nine out of 413 pupils (6.3%) use private latrine while 293 (70.1%) use open-field as places of defaecation while other use public latrine that were built by government or its agents. Higher prevalence of STH parasites were found among pupils that use opened field (45.7%) than 27.0% and 22% for public and private latrine respectively, this difference was significant at $P< 0.05$.

Hand washing habit of the pupils was also investigated in this study with three options: hand washing before meals 177 (42.9%), hand washing after use of toilet 109 (26.4%) and those that neither washes hands before meals nor after use of latrine 127 (30.8%). The prevalence of helminth parasites detected was 13.8, 12.5 and 14.0% in those that wash hands before meals, those that wash hands after use of latrine and those that neither wash before meals nor after use of latrine, respectively.

In this study, four helminth parasites were detected; however majority (30.8%) of them occurred as single parasitic infection in pupils. While very few had multiple infections. Only 19 (4.6%) had two parasites in their stool while only 2 (0.5%) had three different parasites in their stool.

Worm load is very important in determination of infection outcome by helminth parasite. There were five categories per preparation: scanty (1-3), few (4-10), moderate (11-20), many (21-40) and very many (over 40) per a gram of stool (Cheesbrough, 2002). In this present study, most of the pupils (40.1%) had moderate infection, while pupils with heavy infection had prevalence of 8.8%.

DISCUSSION

Previous studies on estimated worm burden showed that globally, 39 million disability adjusted life years were lost due to intestinal helminthiasis (WHO, 1990; Chan, 1997). This modal also estimated that about 70% of the total worm burden of diseases is due to STH infections. High prevalence of STH infection was found among school age pupils of rural communities in Moro LGA of Kwara State. Male pupils had a higher prevalence (42.6%) than the female (40.3%). The present study revealed a high prevalence of 41.9% of STH infection among the pupils in rural communities of Moro Local Government Area. Each of the four rural communities studied had a varying prevalence as illustrated in Table 1. Eggs of hookworm (*A. duodenale*/*N. americanus*) had the higher prevalence than *A. lumbricoides* and whipworm *T. trichiura*. This prevalence was similar to previous studies in several

Table 2. Risk factors and intestinal helminth infections among school children in rural communities of Moro LGA.

Index	Soil transmitted helminthic parasites				
	Yes (%)	No (%)	Total (%)	X^2	P-value
Sex					
Male	84 (42.6)	113 (57.4)	197 (100)	0.2369	0.6264
Female	87 (40.3)	129 (59.7)	216 (100)		
Age group (years)					
5-9	75 (41.9)	104 (58.1)	179 (43.3)		
10-14	86 (39.6)	131 (60.4)	217 (52.5)	04851	0.7846
15-20	08 (47.1)	09 (52.9)	17 (4.1)		
Education level (Primary 1-6)					
1-3	91 (42.7)	122 (57.3)	213 (51.6)		
4-6	80 (40.0)	120 (60.0)	200 (48.4)	0.3152	0.5744
Water Source					
Bore hole	124 (38.6)	197 (61.4)	321 (77.8)		
Well	13 (54.2)	11 (45.8)	24 (5.8)	3.498	0.1738
River/stream	32 (47.1)	36 (52.9)	68 (16.5)		
Latrine facility availability					
Private	2 (22.2)	7 (77.8)	9 (2.2)		
Public	30 (27.0)	81 (73.0)	111 (26.9)	12.956	0.0014
Openfield	134 (45.7)	159 (54.3)	293 (70.1)		
Hand washing habits					
Handwashing before meals	57 (32.2)	120 (67.8)	177 (42.9)		
Handwashing after toilet use	52 (47.7)	57 (52.3)	109 (26.4)	8.817	0.012
Neither any of the above	58 (45.7)	69 (54.3)	127 (30.8)		

developing tropical countries (Tadesse, 2005; Ali et al., 2003; Agi, 1995; Aghere et al., 1995). The average prevalence in some West African countries (Nigeria, Togo and Guinea Bissau) was 5 to 60%) (Molbak et al., 1994).

These three nematodes have been implicated in growth retardation in children in tropical countries (Stephenson et al., 1989), for various reasons such as the cause of iron deficiency anaemia, malnutrition, malabsorption and vitamin A deficiency (Roche and Benito, 1999). In addition, some of the pupils had multiple infections of these parasites. Result showed that 4.6% of the pupils had two STH co-infections and 0.5% had three STH parasites. Multiple infections would have an over-whelming side effect on health of the pupils concerned. Previous report indicated that soil transmitted helminth species are commonly co-endemic (de Silva et al., 2003). Rhabidiform larvae of *Strongyloides stercoralis* were also detected in the faecal samples with low prevalence of 7.1%. Female pupils had higher prevalence of 4.2% while the male pupils had 2.9%. This parasite has also been implicated in growth retardation and stomach pains in pupils.

Other intestinal helminths such as *Enterobius vermicularis* and *Hymenolepis nana* detected in previous studies by Jarallah (2012) and Tappe et al. (2011) in Iraq and Iran, respectively, were not detected in our study, though they were searched for. Age distribution showed that STH infections were more prevalence among age group 15-20 years (47.1%). This is because at such age pupils indicate changes in exposure to conditions that favour the transmission of the infective stage of the STH parasites. Other risk factors to acquisition of STH parasites in rural areas included the use of open-field for toilet as in 70.1% of the pupils studied. About 2.2% of the pupils came from homes that have private latrine facilities. Hand-washing habit of the pupils in these communities is very poor. Only 42.9% of the pupils wash

Table 3. Parasites and intensity.

Parasite in stool sample	Parasites co-infections			
	1	2	3	Total
No. (%)	127 (30.8)	19 (4.6)	2 (0.5)	148 (35.8)

Parasite intensity

Organism	Scanty (+)	Few +	Moderate ++	Many +++	Very many ++++	Total
Hookworm	6	10	33	6	8	63
A. lumbricoides	8	7	20	8	3	46
T. trichiura	11	6	10	4	2	33
S. stercoralis	6	10	6	5	2	29
Total	31 (18.1)	33 (19.3)	69 (40.1)	23 (13.5)	15 (8.8)	171 (100)

their hands before meals, and 26.4% wash their hands after use of toilets while 30.8% of the pupils do not wash hands after the use of toilets nor before meals. The personnel hygiene and poor socio-economic factors contributed to the high prevalence of STH infections in this study (Adedoyin et al., 1990; Allen et al., 2004).

Other important determinants in transmission of STH parasites are poverty and inadequate water supplies and sanitation (Bethany et al., 2006). In the present study, 77.8% of the pupils use bore holes as source of domestic water supply and had least prevalence of 38.6% of STH infection while those that use well had prevalence of 54.2% and stream/river was 47.1% prevalence of STH infection.

Intensity of infection is the main epidemiological index used to describe STH infection, this intensity is measured by the number of eggs per gram of faeces. The distribution of these eggs/larvae showed that majority of the pupils had moderately (++) infection while few were in the two extremes of scanty (+) and very many (++++) (Table 3). Generally, only STH infections of moderate and high produce clinical manifestation (Chan et al., 1994). Previous study indicated that the highest intensity of infections is most common among the school age pupils than adults (Chan et al., 1994; Brooker et al., 2006), and that morbidity from these infections are directly related to the numbers of worms harboured in the host (Arderson and May, 1991).

In conclusion, we reported high prevalence of STH infections among the school pupils in rural communities of Moro LGA of Kwara State and we discussed factors that contributed to this high prevalence. All infected pupils were treated and each class was given health education talk with emphases on hand-washing, wearing of shoe/sandal and personal hygiene. We recommend an improved health education and supervision, regular de-worming, provision of toilets at homes and schools and improved sanitary disposal of human wastes among the pupils and others in the communities to reduce trans-mission of STH infections.

ACKNOWLEDGEMENTS

We are indebted to Kwara State University, Malete, for financial support through Centre for Community Development and to Mr Davis Hannis, the Director, Centre for Community Development for facilitation to village heads.

REFERENCES

Adedoyin MA, Awogun IA, Juergensen T. (1990). Prevalence of intestinal parasitoses in relationship to diarrhoea among children in Ilorin. West Afr. J. Med. 9:83-88

Aghere AD, Atakouma DY, Balaka B. Kessie K. Kuukuvi N. Gnamey DK, Assimadi K (1995). Gastrointestinal and urinary parasitic infections in children at a regional hospital centre in Togo: some epidemiological aspects. Med. Trop (Murs). 55:65-67.

Agi PI (1995). Pattern of inection in intestinal parasites in Sagbama community of the Niger Delta, Nigeria. West Afr. J. Med. 14:39-42

Ali I, Mekete G, Wodajo N. (2003). Intestinal parasitism and related risk factors among students of Asendabo elementary and junior secondary school, South western Ethiopia. Ethiop. J. Health Dev. 13:157-171.

Allen H, Sithey G, Padmasiri EA, Montresor A. (2004). Epidemiology of Soil Transmitted Helminth in the Western region of Bhutan. Southeast Asian J. Trop. Med. Public Health 35(4):777-779.

Anderson RM, May RM (1991). Infectious diseases of human: dynamics and control, oxford, Oxford University Press. pp. 45-78.

Bethany J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, Hotez, PJ (2006) Soil-transmitted helminth infections: ascariasis, trichuriasis and hookworm. Lancet 367:1521-1532.

Brooker S, Clements A, Bundy DAP (2006). Global epidemiology, ecology and control of soil-transmitted helminth infections. Adv. Parasitol. 62:223-265.

Brooker S, Michael E (2000). The potential of geographical information systems and remote sensing in the epidemiology and control of human helminth infections. Adv. Parasit. 47:245-288.

Chan M S, Medley GE, Jamison D, Bundy AA (1994). The evaluation of potential global morbidity, attributable to intestinal nematode infections. Parasitology 109:373-387.

Chan MS (1997). The global burden of intestinal nematode infections-fifty years on. Parasitol. Today 13:438-443

Cheesbrough M (1987). Medical Laboratory Manual for Tropical Countries. Vol. 1 Butterworth & Co (Publisher) Ltd, Borough Green, Sevenoaks, Kent TN15 8PH. pp. 164-174.

Cheesbrough M (2002). District Laboratory Practice in Tropical Countries, Part 1, second edition, Cambridge University Press. pp.

178.235.
de Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Sarioli L (2003). Soil-transmitted helminth infections: updating the global picture. Trends Parasitol. 19:547-551.
Jarallah HM (2010). Intestinal parasitic infections among rural villages in Basrah Marshes regions. J. Basrah Res. (Sciences) 38(2A):40-43
Kwara State Today (1997). A Publication of Kwara State Government, Ministry of information, Ilorin Kwara State. pp. 2-11.
Molbak K, Wested N, Hojlying N, Schentz F, Gottschau A, Aaby P, Da Silva AP (1994). The aetiology of early childhood diarrhoea: a community study from Guinea-Bissau. J. Infect. Dis. 169:581-587.
Murry CJL, Lopez AD (1996). The global burden of disease; a comprehensive assessment of mortality and morbidity from disease, injuries and risk factors in 1990 and projected to 2020. Cambridge, M.A; Harvard University Press. pp. 145-175.
Roche J, Benito A (1999). Prevalence of Intestinal parasite infections with special reference to *Entamoeba histolytica* on the Island of Bioko (Equatorial Guinea). Am. J. Trop. Med. Hyg. 60(2) 257-262
Stephenson LS, Latham MC, Kurz KM, Kinoti SN, Brigham II (1989). Treatment with a single dose of abendazole improves growth of Kenyan schoolchildren with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides*. Am. J. Trop. Med. Hyg. 41:78-87.
Tadesse G (2005). The prevalence of intestinal helminthic infections associated risk factors among school children in Babile town, eastern Ethiopia. Ethiop. J. Health Dev. 19 (2):140-147.
Tappe KH, Mohammadzadeh H, Rhashaveh S, Rezapour B, Barazesh H (2011). Prevalence of intestinal parasitic infections among primary school attending students in Barandooz-chy rural region of Urmia, Est Azerbajan province, Iran in 2008. Afr. J. Microbiol. Res. 5(7):788-791.
WHO (1990). Informal consultation on intestinal helminthes infection. WHO, Geneva, Switzerland July 9-12, (document WHO/CDS/IPI/90.1).
WHO (2004). Prevention and control of schistosomiasis and soil transmitted helminthiasis. Geneva, World Health Organization. pp. 13-28.
WHO (2013). Soil-transmitted helminth infection:Fact sheet No 366, updated June, 2013.