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ORIGINAL ARTICLE

WORM BURDEN OF *ASCARIS LUMBRICOIDES* EXPELLED AMONG PRIMARY SCHOOL CHILDREN AFTER ANTI-HELMINTH TREATMENT IN THREE SELECTED LOCAL GOVERNMENT AREAS OF DIFFERENT SOIL PHYSIO-CHEMICAL PROPERTIES IN OGUN STATE, NIGERIA

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ABSTRACT: Worm burden, Prevalence and intensity studies of Ascaris lumbricoides recovered were assessed after Antihelminthic Levamex (400 mg Levamisole) treatment of 960 school children in Ewekoro, Ado-odo - Ota and Ogun Water-side Local Government of Ogun State, Nigeria. A total of 986 worms were expelled with an overall prevalence of 44.0% (244/555) and mean intensity of 4.0±0.02. The highest prevalence and intensity was observed in Ogun Water-Side local government (59.1%). Analysis of variance (ANOVA) at $P<0.05$ showed that there was significant difference in the prevalence of Ascaris infection when compare the three local government areas. The pattern of frequency distribution of Ascaris worm expelled showed a high worm burden relatively to individual children with overall mean of 3.36 ± 0.12 [Variance $\chi 2 = 5.73(2.64)$]. Greater Ascaris worms distribution was also observed in Ogun Water-Side local government with a mean of 5.2 ± 0.15 [Variance $\chi 2 = 14.2(3.0)$]. Statistical analysis at $P<0.05$ also showed that there was significant difference in the Ascaris worm burden (distribution) in the three local government areas ($P = 0.0011$) while there was no significant difference in the distribution of Ascaris infection within each of the local governments ($P>0.05$). This may be responsible for the nuclear nature of the community coupled with their occupation which exposed both male and female children to Ascaris infection.

INTRODUCTION

Intestinal parasitic infections are among the most prevalent of human parasitic infections worldwide (Omorodion *et al.*, 2012; WHO, 2010). The World Health Organization (WHO) estimated that 270 million pre-school and over 600 million school children in developing countries are living in areas where the parasites are extensively transmitted and are therefore in need of treatment and prevention interventions (WHO, 2010). And remain a serious public health problem in many developing countries especially due to faecal contamination of water and food (Odu *et al.*, 2011a; Odu *et al.*, 2013; Sam–Wobo *et al.*, 2012). Gastro-intestinal parasites are considered as a cause of morbidity and mortality throughout the world particularly in the under developed countries (Odu *et al.*, 2011a; Odu *et al.*, 2013; Adefioye *et al.*, 2011). They are identified one of the most common infections among humans especially in tropical and sub-tropical countries (Awolaju and Morenikeji, 2009; Odu *et al.*, 2011a; Odu *et al.*, 2013).

The prevalence of soil transmitted parasites is approximately one billion people world-wide with school children being the most heavily infected group. It is estimated that over one billion people are infected with *Ascaris lumbricoides* (*A. lumbricoides*) (Kolsky and Blumenthal, 1995). Infection by soil transmitted helminths has been increasingly recognized as an important public health concern, particularly in developing countries (Ibidapo and Okwa, 2008; Mafiana *et al.*, 1998; Sowemimo *et al.*, 2011). Due to this significance, there have been regular endeavours to determine and present figures for soil transmitted helminth (STH) infections in various places such as Nigeria (Brooker, 2003).

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In defiance of the prevalence of parasitic worms, anthelmintic drug discovery is very poor (Smith, 2009). The mere reason is that the nations which suffer most from these helmithiasis infection have little money to invest in drug discovery or therapy. It was discovered that the drugs available for human treatment were first developed as veterinary medicine, (Bersissa, 2010). In a study on the evaluation of the anthelmintics efficacy of Albendazole in school children in seven countries where soil-transmitted helminthes are endemic reported that using Albendazole the prevalence of *A. lumbricoides* was reduced (Vercruyssc, 2011). Not much has been done on the efficacy of anthelmintic drugs in this part of Nigeria and trial has been reported with levamisole by Usip *et al.*, (2013).

Ascaris infection is a major cause of disease burden among children in developing countries (WHO, 2010), especially in sub-Saharan Africa. Intestinal parasitic infections have become a global public health burden and this burden is even higher among children in developing countries. The distributions of worm numbers per host tend to be highly aggregated in form, where most individuals have few parasites and a few individuals have heavy worm burdens (Sam–Wobo *et al.*, 2008).

Diseases burden is an important measure of degree of morbidity and mortality among children in a given population. Worm burden and transmission is intensified by poor socio economic conditions, deficiencies in sanitary facilities, improper disposal of human faeces, insufficient supplies of potable water, poor personal hygiene, substandard housing and lack of education (WHO, 2010).

Two primary factors in maintaining endemicity of intestinal helminthes infections are favourable quantities of the soil and frequent contamination of the environment by human faeces (Emmy-Igbe *et al.*, 2011; Jimenez-Gonzalez *et al.*, 2009; Odu *et al.*, 2011b). Transmission within the community is predominantly related to human habits with regards to eating, defecation, personal hygiene, cleanliness and level of education (Chijioke *et al.*, 2011; Ibidapo and Okwa, 2008). Its prevalence in the community can be used as an evidence of the conditions of living, Environmental factors such as water supply for domestic and personal hygiene, sanitation and housing, conditions and other factors such as socio-economic, demographic and health related behaviour are known to influence this infection (Alli *et al.*, 2011a).

In Nigeria, studies on *A. lumbricoides* infections were carried out in different localities include those of Alli *et al.*, (2011b); Dangana *et al.*, (2011) and Morenikeji *et al.*, (2009). Although several studies point out that intestinal helminth infections are highly prevalent among school children and adults in Ogun State, Nigeria (Akingbade *et al.*, 2013; Banjo *et al.*, 2013; Ekpo *et al.*, 2008; Idowu and Rowland, 2006; Mafiana *et al.*, 2000a; Mafiana *et al.*, 2000b; Morenikeji *et al.*, 2009; Okonko *et al.*, 2009). The finding by Sam-Wobo *et al.*, (2004); Sam-Wobo *et al.*, (2005a); Sam-Wobo *et al.*, (2005b); Sam-Wobo *et al.*, (2007); Sam-Wobo *et al.*, (2008); Sam-Wobo *et al.*, (2012) showed that *A. lumbricoides* is the most prevalent helminth in various communities in Ogun State, South-West Nigeria. This study was accomplished to identify, assess, evaluate the prevalence and worm burden of *A. lumbricoides* using antihelmith and suggests ways by which the level of infection can be reduced in Ogun State, Southern-western Nigeria.

MATERIALS AND METHODS

Study Area

The study areas are three local government areas (Ewekoro, Ado-odo/Ota and Ogun-Waterside) of Ogun State, Nigeria, with selection based on their soil physio-chemical properties (Mafiana *et al.*, 1998). Ogun State is a tropical rain forest zone lies approximately between longitude 2 30'W and 4 30'E, latitude 6 30'S and 8 N. It is bounded in the south partly by the Atlantic Ocean and sharing common boundaries with Lagos, Oyo, Ondo States and Republic of Benin. It has an area of 16,369square/km with population of about 7.5 million (2003 census estimation) and are predominantly Yoruba speaking tribe of Nigeria whose traditional occupations are farming and commerce. The study areas were mapped using the soil-geographical map of Ogun State (Figures 1).

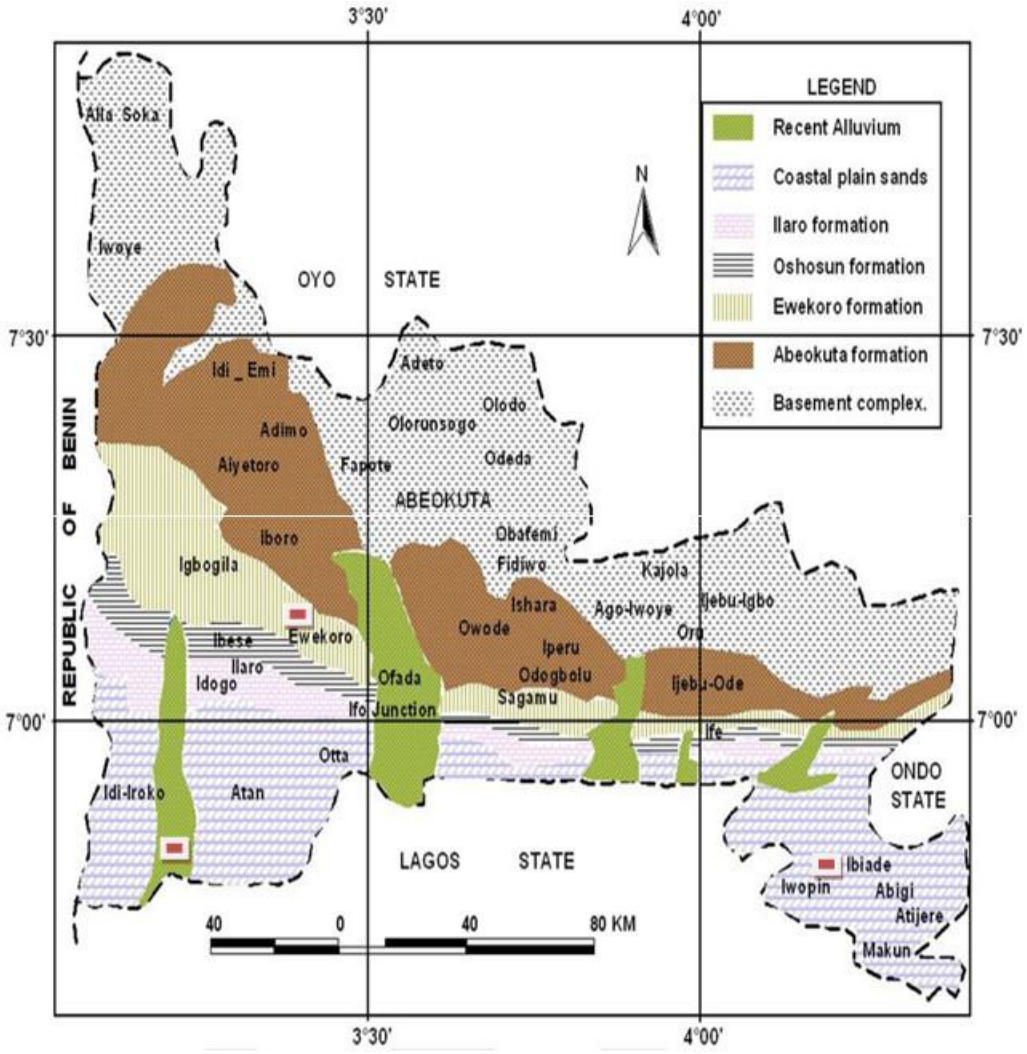

Figure 1: Soil-geographical map of Ogun State showing the selected three local government areas.

Ethical Consent and Approval

Ethical consideration for the study were also observed, consent and approval were obtained from the State Primary School Education Board. Letters were thereafter issued to officials of the Local Government Education Authority in the local government areas, and the head teachers of the selected primary schools for cooperation and assistance during the course of the research study. Parental consents were obtained through the school from Parents/Teachers Association and the school children consent through interactive sessions facilitated by the head teacher of each school.

Sample Population

A total population of 960 pupils which comprised children of four years of age and above (that is, primary 1 to 5 pupils) in the three local government areas were used. Four schools were selected from each local government with a total population of 80 pupils sampled in each school to make a total of 320 pupils from each local government. The study was conducted between 2003 and 2005. The selected schools sampled in each local government are as follow:

- *Ewekoro Local Government*:
  - Baptist Central Primary School, Wasimi, Ogun State
  - All Saint Anglican Primary School, Itori, Ogun State
  - Saint Michael Anglican Primary School, Wasimi, Ogun State
  - Baptist Day Primary School, Egbesi, Ogun State

- *Ado-Odo-Ota Local Government:*
  - Saint Michael Anglican Primary School, Ota, Ogun State
  - Saint James Primary School, Ota, Ogun State

- All Saint Anglican Primary School, Ado-Odo, Ogun State
- Ansar Ur Deen Primary School Ado-Odo Ogun State

➢ *Ogun Water-Side Local Government*:
- Saint Michael Anglican Primary School, Ibiade, Ogun State
- Saint Thomas Anglican Primary School, Abigi, Ogun State
- Muslem Primary School, Abigi, Ogun State
- Local Government Primary School, Makun-Omi, Ogun State

Treatment and Worm Examination
A broad-spectrum Antihelminthic Levamex (containing 40 mg of Levamisole, manufactured by UNIBIOS Laboratories Ltd, India) was administered to all respondents in the study in accordance with manufacturer's instructions (dosage based on age).
The pupils were made to take the drug in our present and they were each given a labelled screw cap plastic container of about 1.5 L with an instruction to pass all stools for the next 24 to 48 h. The stools passed within 24 to 48 hours of treatment were collected, preserved with 10% formalin and transported to the University of Agriculture, Abeokuta, Ogun State, Nigeria. Examination of worm was by flushing the stool with running water through sieve. The worms present were counted and recorded to observe effectiveness of the antihelmith before fixing the worms in 10% formalin.

Data Analysis
Data recorded were analyzed using SPSS Version 16. Analysis of variance (ANOVA) was used to compare relationships between prevalence and intensity of infection in all the three local government areas.

RESULTS

Of 960 pupils from twelve primary schools selected from the three local government areas of Ogun State which comprised children of four years of age and above (>4 years) treated with a broad-spectrum Anti-helminthic Levamex (containing 40 mg of Levamisole). A total of 555(57.8%) [Ewekoro - 196(61.3%), Ado-Odo-Ota - 117(36.6%) and Ogun Water-Side -242(75.6%)] pupils (both male and female) responded with their stools passed within 24 to 48 hours of treatment (Table 1).

Prevalence and intensity of Ascaris Worms Infection
A wide range of prevalence and intensity of *Ascaris* (worms) infection was observed with the three Local Governments areas of different soil physio-chemical properties with an overall prevalence (NI) of 244(44.0%) and mean intensity (MI) of 4.0±0.02. A high prevalence and intensity was observed in Ogun Water-Side local government (59.1%) when compare with other local government areas [Ewekoro - 67(34.2%) 2.3±0.03, Ado-Odo/Ota - 34(29.05%) 1.6±0.04] with low intensity (Table 1). Analysis of variance (ANOVA) at $P<0.05$ showed that there was significant difference in the prevalence of *Ascaris* infection when compare the three local government areas.
As presented in Table 1, effectiveness of Levamisole is observed with rate of ascaris worm expelled in relation to children infected (NI-244(44.0), WE-985). Of 985 worms expelled, a high percentage was observed in Ogun Water-Side local government [778(79.0%)] while other local governments also showed present of *Ascaris* worms.
Analysis of variance (ANOVA) at $P<0.05$ showed a significant difference in *Ascaris* worms expelled in the three local government areas.

Ascaris Worms Burden
Result from table 2 showed effectiveness of Levamisole in de-worming of helminths with observed pattern of frequency distribution of *Ascaris* worms expelled in each school in each local government. A high *Ascaris* worm burden (frequency distribution) with overall mean of 3.36 ± 0.12 [Variance χ^2 = 5.73(2.64)] was observed in all the three local governments areas of Ogun State with majority of the pupils passed between 1-6 *Ascaris* worms followed by 7-11 worms with some pupils passed >20 worms. Greater *Ascaris* worms distribution was observed in Ogun Water-Side local government with a mean of 5.2 ± 0.15 [Variance χ^2 = 14.2(3.0)]. More pupils passed >20 worms in Ogun water-side local government when compare with other local government which indicate a high *Ascaris worm burden*.

Analysis of variance (ANOVA) at P<0.05 showed that there was a significant difference in the *Ascaris* worm burden (distribution) in the three local government areas (P = 0.0011) but there was no significant difference in the frequency of *Ascaris* infection in schools within each of the local governments (P>0.05).

Table 1: Mean Intensity of *Ascaris* among Pupils in Selected Local Government

Local Government	Primary School	N E	N I (%)	W E (%)	M I
Ewekoro	Baptist Central Primary School, Wasimi, Ogun State	59	17(28.8)	27(17.8)	1.6
	All Saint Anglican Primary School, Itori, Ogun State	36	13(36.2)	54(35.5)	4.2
	Saint Michael Anglican Pry. Sch., Wasimi, Ogun State	64	18(28.1)	31(20.4)	1.7
	Baptist Day Primary School, Egbesi, Ogun State	37	19(51.4)	40(26.3)	2.1
Total/Average		196(61.3)	67(34.2)	152(15.4)	2.3±0.03
Ado-Odo-Ota	Saint Michael Anglican Pry Sch., Ota, Ogun State	24	8(33.3)	13(23.6)	1.6
	Saint James Primary School, Ota, Ogun State	27	13(48.1)	22(40.0)	1.7
	All Saint Anglican Pry. Sch., Ado-Odo, Ogun State	45	8(28.8)	12(21.8)	1.5
	Ansar Ur Deen Primary Sch., Ado-Odo, Ogun State	21	5(28.8)	8(14.6)	1.6
Total/Average		117(36.6)	34(29.05)	55(5.6)	1.6±0.04
Ogun Water-Side	Saint Michael Ang. Pry. Sch., Ibiade, Ogun State	69	30(43.5)	130(16.7)	4.3
	Saint Thomas Ang. Pry. Sch., Abigi, Ogun State	50	25(50.0)	63(8.1)	2.5
	Muslem Primary School, Abigi, Ogun State	61	34(55.7)	99(12.7)	2.9
	Local Govt. Pry Sch., Makun-Omi, Ogun State	62	54(87.1)	486(62.5)	9.0
Total/Average		242(75.6)	143(59.1)	778(79.0)	5.4±0.03
Overall prevalence		555(57.8)	244(44.0)	985(100)	4.0±0.02

NE-Number Examined, NI-Number Infected, WE-Worms Expelled, MI-Mean Intensity

Table 2: Frequency Distribution (Worm Burden) of *Ascaris* Worms Expelled by Pupils

Local Government	Primary School	No. Examined	Number of Worms Expelled (class)			
			1-6	7-11	12-19	>20
Ewekoro	Baptist Central Primary Sch., Wasimi, Ogun State	59	8	6	2	1
	All Saint Anglican Primary School, Itori, Ogun State	36	9	2	1	-
	Saint Michael Ang. Pry. Sch., Wasimi, Ogun State	64	12	6	-	-
	Baptist Day Primary School, Egbesi, Ogun State	37	15	-	3	1
Mean = 2.7 ± 0.12 Variance χ^2 = 2.4(1.92) P = 0.081						
Ado-Odo Ota	Saint Michael Anglican Pry Sch., Ota, Ogun State	24	7	1	-	-
	Saint James Primary School, Ota, Ogun State	27	10	-	2	1
	All Saint Anglican Pry. Sch., Ado-Odo, Ogun State	45	5	3	-	-
	Ansar Ur Deen Primary Sch., Ado-Odo, Ogun State	21	5	-	-	-
Mean = 2.2 ± 0.10 Variance χ^2 = 0.6(3.0) P = 0.063						
Ogun Water-Side	Saint Michael Ang. Pry. Sch., Ibiade, Ogun State	69	17	7	5	1
	Saint Thomas Ang. Pry. Sch., Abigi, Ogun State	50	16	5	4	2
	Muslem Primary School, Abigi, Ogun State	61	19	10	2	3
	Local Govt. Pry Sch., Makun-Omi, Ogun State	62	22	17	7	8
Mean = 5.2 ± 0.15 Variance χ^2 = 14.2(3.0) P = 0.035						
Overall Mean = 3.36 ± 0.12 Variance χ^2 = 5.73(2.64) P = 0.0011						

DISCUSSION

The observed high *Ascaris* worm prevalence in the twelve selected primary schools in the three local government areas of Ogun State with different soil physio-chemical properties were almost identical with reports in different parts of the world (Koukounari *et al.*, 2008) and in various states in Nigeria (Adefioye *et al.*, 2011; Alo *et al.*, 2013; Atting *et al.*, 2013; Barnabas *et al.*, 2011; Emmy-Egbe *et al.*, 2012; Osazuwa *et al.*, 2011; Uhuo *et al.*, 2011) and neighbouring communities of Ogun State by Alli *et al.*, (2011a); Odu *et al.*, (2013); Okonko *et al.*, (2009) that the prevalence of *Ascaris lumbricoides* is high in most communities.

While the overall high prevalence observed in the three local governments was in line with result obtained by scientists in studies carried out in Ogun State (Akingbade *et al.*, 2013; Ekpo *et al.*, 2008; Mafiana 1995; Okonko *et al.*, 2009; Sam-Wobo *et al.*, 2005b) that children harbour *Ascaris* infection as adults, depend on the level of exposure to infection.

The higher prevalence of the parasites in Local Government Primary School, Makun-Omi as compared to other schools studied appears to be a reflection of the very poor, debilitated and almost non-existent toilet facilities and improper waste management system, this was also recently reported by Alo *et al.*, (2013) on school children in Ogbarugo, Ebonyi State Nigeria. Hence, environmental sanitation plays a pivotal role in the transmission of most intestinal parasites.

The intensity of *Ascaris* infection in two (Ewekoro and Ado-Odo-Ota) of the three local government was low and apparently low intensity resulted from the level of exposure of individual children to *Ascaris* infection, this was in line with recent results obtained by Ibidapo *et al.*, (2008) and Lorina *et al.*, (2013) in Lagos and Enugu Nigeria. The result of average mean intensity of *Ascaris* 9.0 observed in the local government primary school Makun-Omi in Ogun Water-Side may due to the nuclear

nature of the community coupled with their occupation which exposed both male and female children to *Ascaris* infection, these was in line with the report observation by Awolaju and Morenikeji, (2009) and Ugbomoiko *et al.*, (2009).

Pattern of frequency distribution of *Ascaris lumbricoides* observed in each school from each local government showed a high worm burden relatively to individual children, this showed that most of the children were highly infected with *Ascaris* infection while some showed little or no infection with greater *Ascaris* worms distribution observed in Ogun Water-Side local government, more pupils passed >20 worms when compare with other local government which indicate a high *Ascaris worm burden* and was correspond with results obtained by Fatiregun and Oluwatoba (2008) and Omorodion *et al.*, (2012) which may be due to sanitation, poor environmental conditions, insufficient health care education, lack of toilet facilities, and lack of public health hygiene, coupled with the complete absence of pipe-borne water in the study area.

Effectiveness of Anti-helminth, Levamisole in de-worming with observed pattern of frequency distribution of *Ascaris* worms expelled in each school in each local government and high *Ascaris* worm burden (frequency distribution) with majority of the pupils passed between 1-6 *Ascaris* worms followed by 7-11 worms with some pupils passed >20 worms has also been reported by Odu *et al.*, (2011a); Vercruyssc (2011); WHO (2006) and Usip and Nwosu (2013), indicated that broad spectrum anti-helminthic drug is an effective means of reducing worm burden and its related morbidity.

Based on overall finding on prevalence and rate of burden of *Ascaris* infection in the study areas there is need for further antihelmithic intervention, provision of adequate sanitation, health education to the student through government agencies and non-governmental agencies. This has also been deduced by Ekpo *et al.*, (2008); Sam-wobo *et al.*, (2007); Sam-wobo *et al.*, (2012) in their studies among school children and adults in Ogun State that an integrated approach consisting of mass treatment, safe disposal of waste and provision of latrines in addition to the need for community and health education.

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