Peak Journal of Public Health and Management Vol. 3 (3), pp. 46-55, April, 2015
http://www.peakjournals.org/sub-journals-PJPHM.html
ISSN 2329-2997

Full Length Research Paper

The prevalence of intestinal helminthes and efficacy of anthelmintic (pyrantel) drugs among primary school children in Obot Akara Local Government Area, Akwa Ibom State, Nigeria

Usip L. P. E.* and Matthew E. E.

Accepted 02 April, 2015

A study on the current status of intestinal helminthes and the efficacy of anthelmintic drugs was carried out among primary school pupils in Obot Akara Local Government Area of Akwa Ibom State, Nigeria. A total of 316 faecal samples were collected randomly from the school children and analyzed using standard parasitological procedures. Data obtained showed an overall prevalence of 193 (61.1%) out of 316 sampled, and the efficacy of anthelmintic in reducing the worm burden was 142 (78.9%). Out of 180 samples treated, age related prevalence and efficacy of anthelmintic (Pyrantel) drug varied across the sampled groups. There was no significant difference in sex related infections in the sample group (P>0.05). The efficacy of the drugs reduced with increase in age. Also the efficacy of Pyrantel drug in reducing the worm burden were hookworm 44 (71.0%), *Ascaris lumbricoides* 38 (71.7%), *Trichuria* 40 (100%), *strongyloides stercoralis* 6 (66.7%) and *Enterobius vermicularis* 14 (100%), while *Taeniasp* showed drug resistance. This indicates that a single dose of the medication is not enough for total elimination of these parasites. The study revealed that poor hygiene practices and unsanitary conditions were responsible for high prevalence recorded in the area and advocated for health education through primary health care and mass deworming of primary school children as a control measure.

Key words: Children, pyrantel drug, deworming, infection.

Department of Zoology, University of Uyo, Akwa Ibom State, Nigeria.

*Corresponding author. E-mail: usiplaw01@gmail.com, Tel.: 08065928365, 08027964421

INTRODUCTION

Parasitic diseases continue to be a major public health problem all over the world, accounting for over two billion infections per year worldwide with associated high degree of mortality and man-day loss. These present a major challenge to health and wellbeing of millions of people across the globe, particularly those living in the poorest regions, mainly in the tropics and subtropics (Arora and Bala, 2012).

Intestinal helminthes are parasitic worms that live in the gastrointestinal tract of their hosts, though they may also wonder into other organs during larval migration, where they induce physiological damage (Banke et al., 2006). They remain the major cause of wildlife diseases, economic crises in livestock industry, and human socio-economic problems in developing countries, because of their high prevalence and amenability to control (Hotez et al., 2009).

Ascariasis, hookworm infection and trichiuriasis are among the top ten most common infections in the world (Nokes et al., 1992). These infections continue to be a global health problem, particularly among children in poor communities in developing countries (Farag, 1995).

The Intestinal helminthes of importance to man are *Enterobius vermicularis* (pinworm), *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), *Necator americanus, Ancylostoma duodenale* (Hookworms) and *Strongyloides stercoralis* (threadworm) (Noor et al., 1978; Rahman, 1991; Robertson et al., 1992; Salman, 1997).

With the exception of *E. vermicularis*, intestinal trematodes and cestodes, most of the common intestinal helminthes infections of man are faecal-borne infections and the transmission occurs either from hand – to – mouth or directly through food and water (Mordi and Paul, 2007).

Intestinal helminth infections are widespread among children in the tropics and subtropics. These infections are rarely fatal but they may impair growth, physical fitness, cognition, and reduce school attendance and performance (Bethony et al., 2006; Nokes et al., 1992). Children between 5–14 years of age in developing countries are especially at risk of soil-transmitted helminth (STH) infections (WHO, 1991).

Indiscriminate defecation around human habitations has serious health implications. It has been established that such low standard of sanitation, hygiene and poor socio-economic conditions are predisposing factors to infections and reinfections with gastrointestinal helminthes (Emmy-Igbe et al., 2011; Eze and Nseako, 2011). Several helminth parasites have been implicated in causing morbidity in the lives of people worldwide.

A large variety of chemotherapeutic drugs such as*piperazine, Benzimidazole, Levamisole; pyrantel; morantel,* paraherquamide, lvermectin have been developed and commercialized, yet all major helminthiasis are classified under neglected diseases with infestations rampant as ever (Vercruyssc*,* 2011). The efficacy of anthelminthic drugs (Levanisole) indicated that worm burden reduces with increase in age with *Ascaris sp*, hookworm and *Trichurissp* while *Teania sp* and *Strongyloides* sp showed drug resistance in children in Enugu State, Nigeria (Ukwubile et al., 2013). Large scale prevention and treatment remain a global crises due to constraints on the application of these otherwise effective drugs. In endemic regions, mass treatment is practiced particularly among school-age children who are the high-risk group (Islam, 2005; Usip and Nwosu, 2013).

The Objectives of the Study were:

1. To determine the prevalence of intestinal helminth infection among primary school children in Obot Akara Local Government Area in Akwa Ibom State, Nigeria.
2. To determine the prevalence of intestinal helminth in relation to age and sex.
3. To determine the efficacy of anthelminthic (pyrantel) drugs in the treatment of intestinal helminth infection.

MATERIALS AND METHODS

Description of study area

Obot Akara is located in the south East of Nigeria and it is a Local Government Area in Akwa Ibom state. Akwa Ibom lies between the coordinates; Latitude 4° 32’ and 5° 53’ North, and Longitudes 7° 25’ and 8° 25’ East with total land area of 8412 km^2. Obot Akara lies between latitude 5° 14’ 48.1’’ (5.2467°) North and longitude; 7° 36’ 16.15’ (7.6046°) East, with average elevation of 84 m (276 ft), with total land mass of 237 km^2. Vegetation and climate is typical of the tropical rainforest, since the region is in the rainforest belt of the country (Nigeria; Figure 1). The local government area is a typical rural area which lacks basic social amenities, such as adequate portable water, good road network, sanitary facilities, adequate health centers, and public schools with adequate facilities. Majority of the people depend on streams and rivers for water, with very few that can afford bore-hole water. It is an amalgamation of three clans: Obot Akara Clan, Ikot Abia Clan, and Nto Edino Clan. From the (2006) national census it is populated with about 148,281 people (76,579 male and 71,702 female). The people are predominantly farmers, hunters, and some are into craft making, while few are civil servants. The selection of the primary school was based on pupil’s attendance, location and school environments. After a preliminary inspection of schools, one school was selected from each clan, making it a total of three (3) primary schools. The schools are surrounded with bushes which the pupils sometimes use indiscriminately for defecation, the play grounds are made of loose soil, and most of the pupils go about bare-footed in the play grounds.

Ethical consideration of the study

A letter of introduction was obtained from the supervisor of the study and submitted to the head teacher of the selected schools; the introduction and proposal of the study was declared by the researcher to the staff of the school in a meeting between the researcher and the staff of the school, and ethical clearance for the study was obtained from ethical committee of the ministry of health.

The parents/guardians of the pupils were invited and taught on helminthes and their effects on health. There their consent was sought for the participation of their wards in the study which was voluntary. These were repeated throughout the schools selected for the study.

Sampling techniques

Sterile universal containers were given to the pupils who volunteered to take part in the study, with their identification number clearly written on it. The children were told to get their early morning faecal samples along with them while coming to school the next morning. They were told to use the WHO (1991) method; the stool was to be passed on a clean paper first before scooping a little portion into the sample bottle using a piece of dry broom stick and the bottle cap was well corked. The samples collected were analyzed without preservation. The samples were analyzed at the University of Uyo

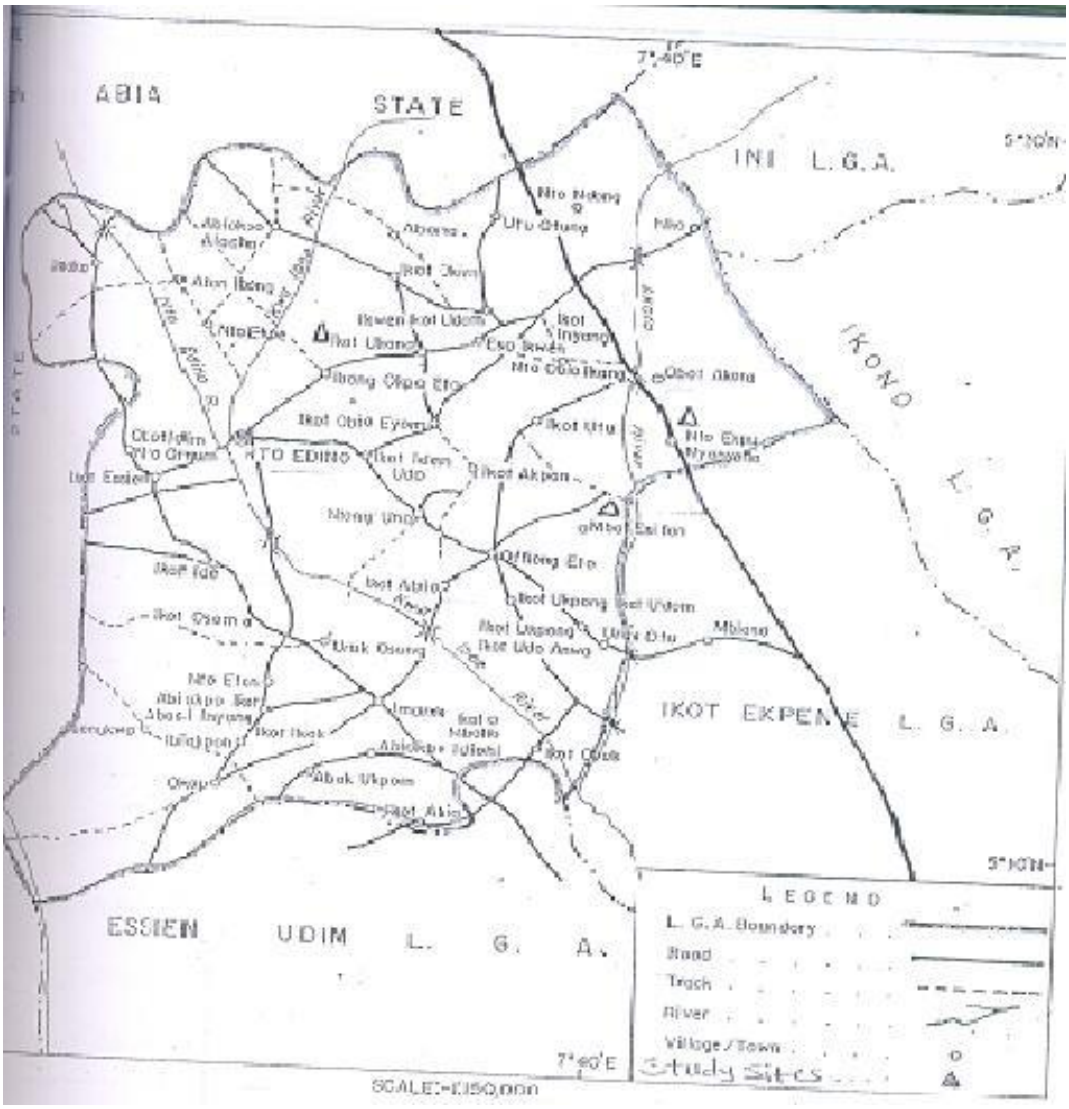

Figure 1. Map showing study sites of Obot Akara Local Government Area. Sources: Office of the state surveyor general, Uyo, Akwa Ibom State.

Health center Laboratory for eggs (ova), larvae, and parts of helminthes using the standard parasitological method described by WHO (1991), with assistance from the laboratory technologists.

Two methods: saline wet mount and formol-ether concentration technique were used alternatively. On completion of the diagnostic tests, the results of the analysis were taken to the schools and with the help of the class teachers, those infected were asked to come to school along with their parents/guardians the next day for their result. After disseminating the results to each patient, the anthelmintic (a single dose of pyrantrinpamoate 125 mg) was given by the community medical officer who also explained the possible long reactions. After two (2) weeks, which was a period given for the drug to expel the parasites; a follow-up test was conducted on the infected pupils who received the treatments.

Data Analysis

The results of the study (data) were analyzed using t-test, and chi-square (X^2).

RESULTS

The result in Table 1 shows the prevalence of the Helminth parasites encountered from the faecal samples collected from pupils in three different primary schools. Out of 316 pupils examined, 193 (61.1%) were infected

Table 1. The prevalence of various intestinal helminthes.

Site	Number of pupils sampled	Number infected	Helminth parasites encountered					
			A. Lumbricoides	Hookworm (*A. duodenale)*	*T. trichiura*	*E. vermicularis*	*S. tacoralis*	*Taenia sp.*
A	114	72	23	22	17	7	3	0
B	102	67	19	28	12	2	5	1
C	100	54	15	18	13	6	1	1
Total	316	193 (61.1%)	57 (29.5%)	68 (35.2%)	42 (21.8%)	15 (7.8%)	9 (4.7%)	2 (1.0%)

Site A represents ObotAkara clan; Site B represents IkotAbia clan; Site C represents Ntoedino clan.

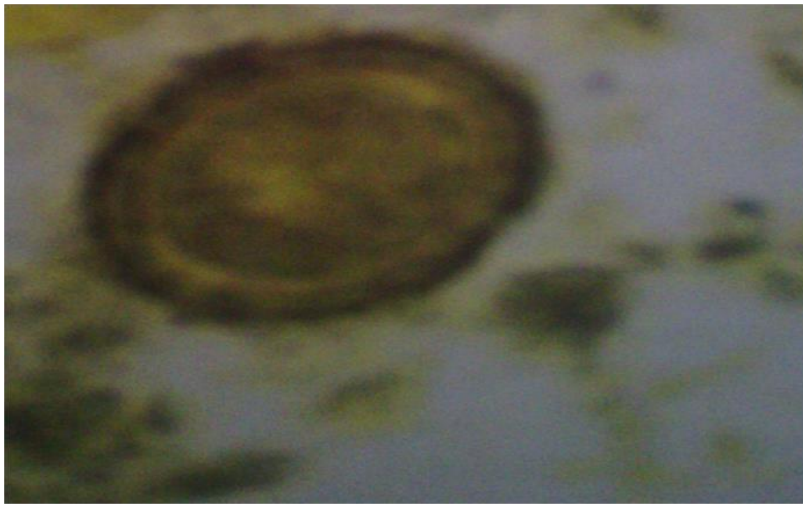

Plate 1. The microscopic view of egg of *Ascaris lumbricoides.*

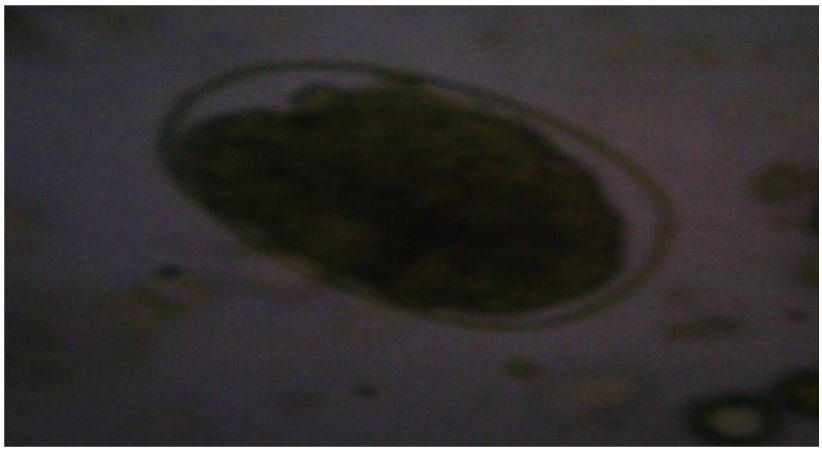

Plate 2. The microscopic view of egg of hookworm.

with intestinal Helminth parasites. The intestinal Helmith parasites encountered were: *A. lumbricoides* 57 (29.5%), Hookworm *(A. duodenale)* 68 (35.2%), *T. trichiura* 42 (21.8%), *E. vermicularis* 15 (7.8%), *S. stercoralis* 9 (4.7%) *and Taenia sp.* 2 (1.0%). Hookworm (*A. duodenale*) was the highest prevalent (35.2%), while *Taenia sp.* (1.0%) was the lowest prevalent (Plates 1 – 4).

Figure 2 is a pie chart showing the frequency of the prevalence of various intestinal helminthes. It shows that

Plate 3. The microscopic view of egg of *Trichuris trichiura*.

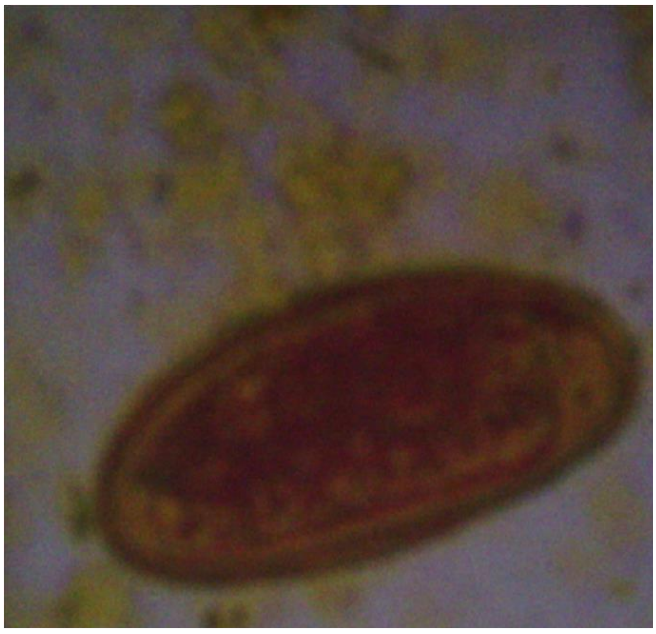

Plate 4. The microscopic view of egg of *Eterobius vermicularies*.

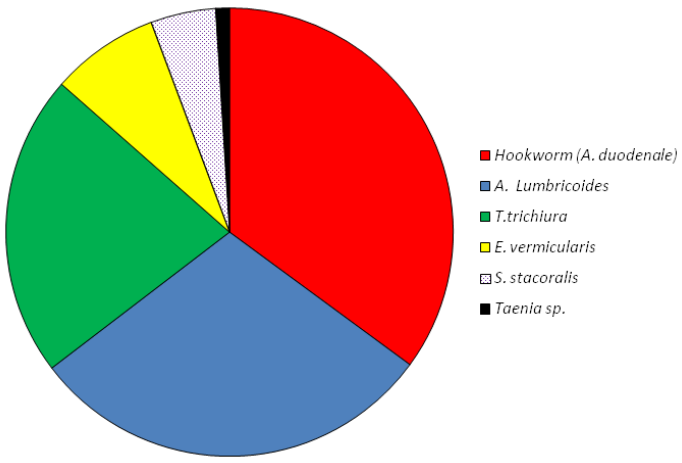

Figure 2. Frequency of the prevalence of various intestinal helminthes.

Table 2. The rate of multiple infection.

Multiple infection	Number/percentage of prevalence (%)
A. lumbricoides and Hookworm	17 (53.1)
Hookworm and *S. stacoralis*	4 (12.5)
T. trichiura and *E. vermicularis*	2 (6.3)
T. trichiura and Hookworm	2 (6.3)
A. lumbricoides and *E. vermicularis*	2 (6.3)
A. lumbricoides and *S. stacoralis*	1 (3.1)
Hookworm and *E. vermicularis*	1 (3.1)
A. lumbricoides, Hookworm and *S. stacoralis*	1 (3.1)
A. lumbricoides, Hookworm and *E. vermicularis*	1 (3.1)
Hookworm, *T. trichiura* and *E. vermicularis*	1 (3.1)
Total	32

Table 3. Prevalence of infection in relation to sex.

Sex	Number examined	Number infected	Percentage of infection (%)
Male	155	101	65.2
Female	161	92	57.1
Total	316	193	61.1

Table 4. Prevalence with respect to sex and age.

Age	Total number examined	Total number infected	Male		Female	
			Number examined	Percentage number infected (%)	Number examined	Percentage number infected (%)
5	38	25	22	16(68.2)	16	9(56.3)
6	44	36	24	21(87.5)	20	15(75.0)
7	47	39	26	19(73.1)	21	20(95.2)
8	36	20	15	10(66.7)	21	0(47.6)
9	38	23	12	8(66.7)	26	5(57.7)
10	25	11	11	5(45.5)	14	6(42.9)
11	28	14	18	10 (55.6)	10	4(40.0)
12	38	17	17	9(52.9)	21	8(38.1)
13	22	8	10	3(30.0)	12	5(33.3)
Total	316	193	155	101(64.5)	161	92(59.0)

hookworm (*A. duodenale*) 68 (35.2%) is the most prevalent, followed by *A. lumbricoides* 57 (29.5%), *T. trichiura* 42 (21.8%), *E. vermiculeris* 15 (7.8%), *S. stacoralis* 9 (4.7%) and *Taenia sp.* 2 (1.0%).

The prevalence rate of multiple infections is indicated that in Table 2, seven cases of mixed infection with two parasites, and 3 cases with three parasites of multiple infections were recorded out of 10 cases of polyparasitism. The result in Table 3 shows that males had the higher prevalence 101 (65.2%) out of 155 males examined. The females had the lower prevalence 92 (57.1%) out of 161 females examined. However, there was no statistical $p < 0.05$ difference in prevalence of infection between male and female.

The result of the prevalence of helminthes with respect to sex and age in Table 4 shows that the highest level of infection was recorded among children of ages 6 and 7 in both the males and females, but males of age 6 were the highest infected recording 21 (87.5%), while females who recorded the highest infection 20 (95.2%) were those of age 7. Tables 5 and 6 also show that infection decreased with increase in age in both sexes.

t^2 calculated at 3 degree of freedom and 5% probability level is 0.28 whereas t tabulated = 2.44, some cal t^2 is

Table 5. The frequency of prevalence of various intestinal helminthes with respect to age group and sex.

Age group	Number examined	Percentage number infected (%)	Percentage Hookworm (%)	Percentage *A. lumbricoides* (%)	Percentage *T. trichiura* (%)	Percentage *S. stercoralis* (%)	Percentage *E. vermicularis* (%)	Percentage *Taenia sp.* (%)
5-6	M=48	47(97.9)	17(36.2)	14(29.8)	11(23.4)	3(6.4)	2(4.3)	0(0.0)
	F=34	20(58.8)	6(30.0)	4(20.0)	5(25.0)	1(5.0)	3(15.0)	1(5.0)
	T=82	67(81.7)	23(34.2)	18(26.9)	16(23.9)	4(6.0)	5(7.5)	1(1.5)
7-8	M=41	29(70.7)	12(41.4)	9(31.0)	3(10.3)	1(3.4)	4(13.8)	0(0.0)
	F=42	20(47.6)	6(30.0)	6(30.0)	6(30.0)	0(0.0)	1(5.0)	1(5.0)
	T=83	49(59.0)	18(36.7)	15(30.6)	9(18.4)	1(2.0)	5(10.2)	1(2.0)
9-10	M=23	13(56.5)	6(46.2)	4(30.8)	2(15.4)	0(0.0)	0(0.0)	0(0.0)
	F=40	18(45.0)	9(50.0)	7(38.9)	3(16.7)	0(0.0)	0(0.0)	0(0.0)
	T=63	31(49.2)	15(48.4)	11(35.5)	5(16.1)	0(0.0)	0(0.0)	0(0.0)
11-13	M=45	26(44.4)	5(19.2)	8(30.8)	7(26.9)	3(11.5)	2(7.7)	0(0.0)
	F =43	20(60.5)	7(35.0)	5(25.0)	5(25.0)	1(5.0)	3(15.0)	0(0.0)
	T=88	46(52.3)	12(26.1)	13(28.3)	12(26.1)	4(8.7)	5(10.9)	0(0.0)
Grand total	316	193(61.1)	68(35.2)	57(29.5)	42(21.8)	9(4.7)	15(7.8)	2(1.0)

$p < 0.05 = 0.28$, χ^2 tab = 9.438, χ^2 cal 104.5. M = Male, F = Female and T= total, numbers in bracket indicates percentage infection, number outside bracket indicates number of cases witness.

Table 6. Showing prevalence with respect to age group and sex.

Age group	Total number examined (%)	Male (%)		Female (%)	
		Number examined	Number infected	Number examined	Number infected
5-6	82(25.9)	46(56.1)	37(80.4)	36(43.9)	24(66.7)
7-8	83(26.3)	41(49.4)	29(70.7)	42(50.6)	30(71.4)
9-10	63(19.9)	23(36.5)	13(56.5)	40(63.5)	21(52.5)
11-13	88(27.8)	45(51.1)	22(48.9)	43(48.9)	17(39.5)
Total	316	155(49.1)	101(65.2)	161(50.9)	92(57.1)

$p < 0.05$ (two tailed) t-cal = 0.28, t-tab = 2.448 numbers in bracket indicates percentage infection, number outside bracket indicates number of cases witness.

Table 7. Reduction of worm infection (efficacy of anthelmintic drug) in relation to age group.

Age group	Number infected (%)	Before treatment	After treatment	
		Number treated (%)	Number infected (%)	Number not infected (%)
5-6	67(34.7)	50(74.6)	6(12.0)	44(88.0)
7-8	49(25.4)	45(91.8)	9(20.0)	36(80.0)
9-10	31(16.1)	31(100.0)	10(32.3)	21(67.7)
11-13	46(23.8)	46(100)	13(28.3)	33(71.7)
Total	193(61.1)	172(89.1)	42(24.4)	138(80.2)

$p > 0.05$, df =3, X^2cal (107.9), X^2_{tab} (7.81), number in bracket indicate percentage infected, number outside bracket indicate number witness.

less than tabulated t^2 null hypothesis is rejected and there is no significant difference between male and female prevalence of infection with ages. Table 7, Figures 2 and 3 show that 67 (34.7%) pupils were infected among the

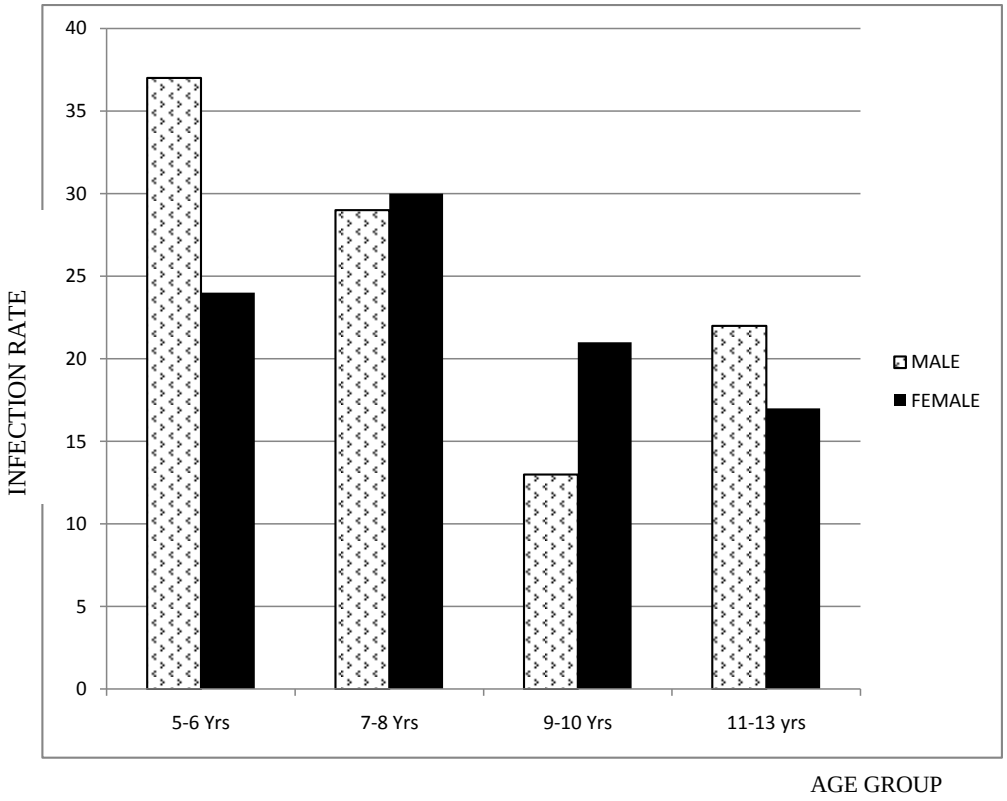

Figure 3. A bar chart of the rate of infection with intestinal helminthes with respect to age and sex.

Table 8. Reduction in worm burden (Efficacy of Anthelmintic Drugs) in relation to sex

Sex	Before treatment	After treatment	
	Number infected	Number infected (%)	Number not infected (%)
Male	98	21 (21.4)	77 (78.5)
Female	82	17 (20.7)	65 (79.2)
Total	180	38 (21.1)	142 (78.9)

$P < 0.05$, χ^2 calculated 105.42, χ^2 tabulated 7.8, number in bracket percentage infected/not infected, number outside bracket indicate number witness.

5-6 age group, and 50 (74.6%) were treated with Anthelmintic drug; but 44 (88.0%) were dewormed, while 6 (12.0%) were not dewormed. Also, efficacy of the drug decreased with increase in age.

Table 8 shows the reduction of worm burden with respect to sex after treatment with Anthelmintic drug. Out of 193 pupils that were with infection, 180 were treated with Anthelmintic drug. 98 Males were treated, but 77(78.5%) were actually dewormed after treatment while 21 (21.4%) still harbored the parasites. And out of 82 females treated, 65 (79.2%) were dewormed, while 17 (20.7%) still harbored the parasites.

Table 9 shows that out of 62 pupils infected with Hookworm, 44 (71.0%) were actually cleared after treatment with Anthelmintic drug. *T. trichiura* and *E. Vermicularis* were totally cleared. Also there was great reduction in number of other intestinal Helminthes, while *Taenia sp.* showed resistance to the drug (Figure 4).

DISCUSSION

The study revealed an overall prevalence of (61.1%) intestinal helminth infection among primary school children. The high prevalence is similar to high prevalence in the work done by Usip and Nwosu (2013), Uwem (2004), Ukpai et al. (2003) and Eze and Nzeako (2011), and it is in contrast with the low prevalence rate recorded by the work done by Elekwa and Ikeh (1996) and Emmy-Igbe et al. (2011). The differences in the

Table 9. Reduction of worm burden (Efficacy of Anthelmintic Drug) of various intestinal helminthes.

Prevalence of helminthes	Before treatment	After treatment	
	Number treated	Number infected (%)	Number not infected (%)
Hookworm	62	18(29.0)	44(71.0)
A. lumbricoides	53	15(31.6)	38(71.7)
T. trichiura	40	0(0.0)	40(100.0)
S. stercoralis	9	3(33.3)	6(66.7)
Taenia. sp.	2	2(100.0)	0(0.0)
E. vermicularis	14	0(0.0)	14(100)
Total	180	38(21.1)	142(78.9)

$P < 0.05$, χ^2 cal = 105.42, χ^2 tab 7.81

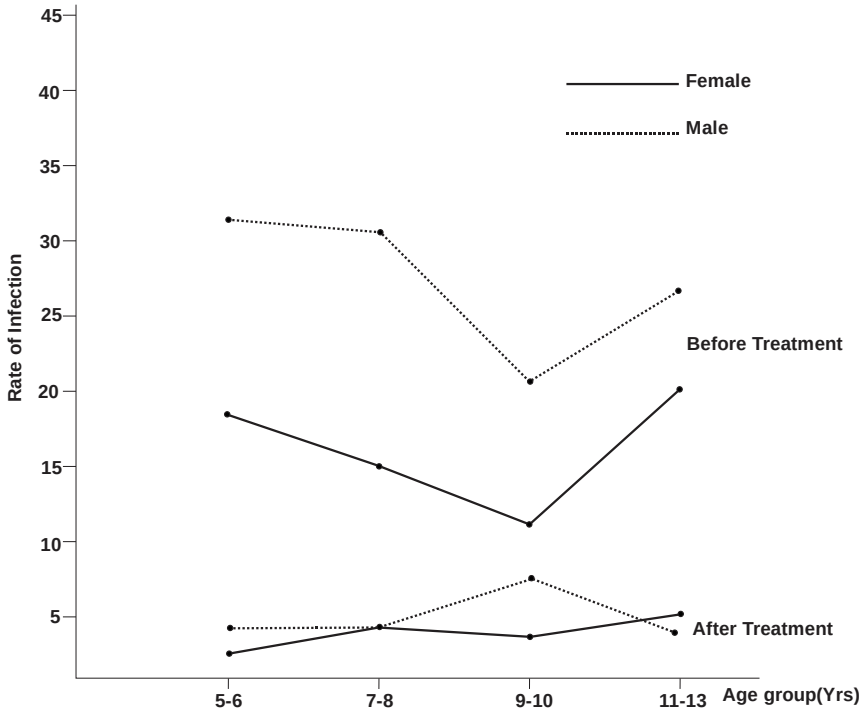

Figure 4. Graph of the efficacy of anthelmintic drug with sex and age group.

prevalence of the parasites in the studies mentioned may be as a result of number of samples obtained, age brackets examined geographical factors in the study area, and seasonal changes as previously reported by Uneke et al. (2007) and Utzinger et al. (1999).

Table 1 showed that hookworm (*A. duodenale*) was the highest prevalent (35.2%), followed by *A. lumbricoides* (29.5%), *T. trichiura* (21.8%), *S. stacoralis* (4.7%), *E. vermicularis* (7.8%), *Taenia sp.* (1.0%) respectively. This is similar to the work carried out by Usip and Nwosu (2013), Uwem (2004), Ukpai et al. (2003) and Eze and Nzeako (2011). The high prevalence of hookworm may be attributed to the school children usually going bare footed into bushes, and play grounds, and having contacts with infested soil and objects, which enhances penetration of the infective larvae into the skin. The high prevalence of *A. lumbricoides, and T. trichiura* could be attributed to contamination of food and water with faeces, since transmission is faecal to oral. Generally, the high prevalence of soil transmitted helminthes could be attributed to availability of the infective stage of the worms and the damp nature of the study sites which is favorable to the hatching and development of the worms larvae. The low prevalence of *Taenia sp.* may be due to poverty, eating only healthy animals or meat processing. The high prevalence of multiple infection (polyparasitism) observed in this study is similar to the work done by Emmy-Igbe et al. (2011) and Usip and Nwosu (2013).

The males had the higher infection rate (65.2%) than females (57.1%). This is similar to the work done by Eze and Nzeako (2011). And this may be attributed to the fact that males are involved in outdoor activities than female, and by their interaction with the contaminated soil, also, female are more hygienic than male in terms of feeding.

After the administration of anthelmintic drug, the overall infection rate was 142 (78.9%) out of 180 treated. This is similar to work done by Vercruysse et al. (2011), Islam (2005) and Bersissa (2010) who had 92.5, 85, and 100%, respectively. This implies that all anthelmintic drugs in their chemical class kill worms in the same manner though the effectiveness within chemical families varies and none is 100% efficient in its efficacy. Thus the pharmaceutical companies should research more and develop new anthelmintics to replace the current ones before helminthes exert total resistance to the currently available anthelmintics.

The variability in the efficacy of the drug among the helthminthes species may be related to the immunological competent of each worm species. Also *Taenia sp.* showed resistance to the drug, and this could be attributed to the impotency of the drug in clearing the worm species, but can only be effective against the worm when combined with another anthelmintic drug class.

The rate of reduction of the worm burden also varied with in line with previous report by Ukwubile et al. (2013). As age increased, reduction of the infection decreased. This trend is because the adult worm in older pupils has developed immune mechanisms to resist drug action. Also there was no significant difference with sex since reduction rate in males was 21.4%, and 20.7% in females. This is because sex is not a criterion for drug action.

Conclusion

In conclusion, the prevalence of intestinal helminth infections, especially the soil transmitted, and faecal oral borne are very high in the school children. The high prevalence in this population of children indicates that the helminthes concerned are very common in the environment of the villages and the results of the study suggest that transmission is from several routes. Therefore, government and nongovernment organizations should implement the multiple intervention strategies for the school children, households, and environment for reduction of intestinal helminth infections, since health they say is wealth.

REFERENCES

Arora DR, Bara BA (2012). Medical Parasitology, 3rd edition. CBS publishers and distributors. 3-6, 233-245.

Banke R, Omudu OK, Edward AI, Dorathy A, Iveren J (2006). Prevalence of gastrointestinal parasites in relation to availability of sanitary facilities among schooling children in Markurdi, Nigeria. Int. J. Parasitol. 3:489-93.

Bersissa L (2010). The efficacy of albendazole, tetramisole and ivermectin against gastrointestinal nematodesin naturally infected goats in Ziway. Int. J. Parasitol. 4:77-78.

Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D (2006). Soil-transmitted helminth infections: Ascariasis, trichuriasis, and hookworm. Lancet 367:1521–32.

Elekwa DE, Ikeh EIA (1996). A survey of the incidence of intestinal parasites among primary school children in relation to socio economic factors in Jos. Niger. Med. Parasitol. 31(4):60-62.

Emmy-Igbe IO, Ekwesianya EO, Ukaga CN, Eneanyi CI, Ajaero CM (2011). Prevalence of intestinal helminth in students of Ihiala Local Government Area of Anambra state. Parasitology 3:247-49.

Eze NC, Nzeako SO (2011). Intestinal Helminth amongst Hausa and Fulani settlers in Obinze, Owerri, Imo State, Nigeria. Nig. J. Parasitol. 32(2):225-29.

Farag H (1995). Intestinal parasite in the population of the Yemen Arab republic. Trop. Geogr. Med. 37:29-39

Hotez PJ, Fenwick A, Savioli L, Molyneux DH (2009). Rescuing the bottom billion through control of neglected tropical diseases. Lancet 373:1570–5. [PubMed].

Islam B (2005). Comparative efficacy of some modern anthelmintics and pineapple leaves with their effect on certain blood parameters and body weight gain in Calves. Int. J. parasitol. 3:71-88.

Mordi RM, Paul O (2007). A study of blood and gastrointestinal multivalent anthelmintic vaccine to prevent hookworm and parasites in Edo State. Afr. J. Biochem. 6(19):2201-2207.

Nokes C, Grantham-McGregor SM, Sawyer AW, Cooper ES, Bundy DA (1992) Parasitic helminth infection and cognitive function in school children. Proc. Biol. Sci. 247:77–81.

Noor MI, Sano MI, Mohammod CG, Norhayati M, Roham AK, Halimah AS (1978). Prevalence of parasitic infection in Malaysian oil palm Estate workers, Southeast Asian. J. Trop. Med. Pub. Health 2:272-76.

Rahman WA (1991). Prevalencee of *Enterobius vermicularis* in man in Malaysia. Trans. R. Soc. Trop. Med. Hyg. 85:249.

Robertson LJ, Cromption DWT, Sanjur D, Neshum MC (1992). *Trichuris trichuira* and the growth of primary school children in panama.Trans. R. Soc. Trop. Med. Hyg. 86:656-57.

Salman AB (1997). Management of intestinal obstruction caused by ascariasis. J. Pediatr. Surg. 32(4):585-587.

Ukpai OM, Ugwu CO, James PR (2003). The prevalence of gastrointestinal parasites among primary school children in Ikwuano L.G.A of Abia State, Nigeria. Nig. J. Parasitol. 24:129136.

Ukwubile CA, Olalu O, Akpabio U, Agu MA (2013). The prevalence of parasitic human intestinal helminthes and the efficacy of anthehelmentic drug in children in Uzo-Uwani Local Government Area, Enugu State, Nigeria. Open J. Med. Microbiol. 3:213-218.

Uneke CT, Eze OK, Oyibe RG, Azu NC, Ali E (2007). Soil-transmitted helminthes infection in school children in south-Eastern Nigeria. Public Health Implication Internet J. third World Med. 4(1):1-12.

Usip LPE, Nwosu CD (2013). The prevalence of human intestinal helminthes and the efficacy of anthelmentic levamisole drug. Basic Res. J. Med. Clin. Sci. ISSN 2315-6864 2(5):52-58.

Utzinger JN, Goran EK, Marti HP (1999). Intestinal amoebiasis, Giardia Lemblia and Geohelminthes their Association with other Intestinal Parasites and reported Intestinal Symptoms. Trans. Royal Soc. Trop. Med. Hyg. 93(2):137-41.

Uwem FE (2004). Demographic characteristics of schoolchildren in government-owned urban and rural schools and an urban school, in Ikenne L. G. A., Ogun State, Niger. J. Parasitol. 24(30): 27228.

Vercruyssc (2011). Assessment of the Anthelminties efficacy of Albendazole in school children in seven–countries where soil transmitted helminthes are endemic. Simon Broker. London School of Hyg. Trop. Med. United Kingdom. Int. J. Parasitol. 9:201-7.

WHO (1991). Intestinal Protozoa and Helminthes Infection. J. Parasitol. World development report 1993. New York: Oxford University Press; World Bank; pp. 25–9.