PREVALENCE OF INTESTINAL HELMINTHS AMONG PRIMARY SCHOOL CHILDREN IN IHUMUDUMU COMMUNITY, EKPOMA, EDO, NIGERIA

[1]EDOGIAWERIE, D., [1]TURAY, A.A., [2]OKPALA, H.O.

[1]Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria. [2]Igbinedion University, Okada, Edo State, Nigeria

Email – denniswise83@gmail.com

ABSTRACT

A survey of intestinal helminth parasites among school pupils was conducted in two primary schools within Ihumudumu community of Ekpoma, in Esan West Local Government Area of Edo State, Nigeria, between December 2012 and February 2013. A total of 380 faecal samples were randomly collected from pupils of both sexes whose ages ranged between 5-14 years. Using the direct wet smear and formol-ether sedimentation techniques to process the faeces, 71(18.7%) of the samples were found positive for various intestinal helminths; with Hookworm accounting for 8.4% of total number examined. *Ascaris lumbricoides* was 3.4%, *Trichuris trichiura* 2.6%, *Enterobius vermicularis* 1.1%, *Schistosoma mansoni* 0.8%, *Strongyloides stercoralis* 0.8%, and *Fasciola spp.* 0.5%. Mixed infections were observed in 4(1.1%) of the pupils. Sex did not significantly affect the pattern of infection (P>0.05) but age affected it significantly (P<0.05). Infections were detected in both schools with the difference being statistically significant (p < 0.05). Our findings indicated that intestinal helminthiasis was relatively not prevalent in the area, and as such, control and preventive measures such as chemotherapy, provision of adequate sanitary facilities and potable drinking water, improved personal hygiene and Health education should be the focus of government and non-governmental Health providers.

Key Words: Prevalence, Intestinal helminthes, Parasites, School children.

INTRODUCTION

A parasite (literally *Para* – beside, *sitos* – food) is any organism that derives benefit from living in, or on another organism (the host), at a cost to the host (Northrop-Clewes and Shaw, 2000). The cost may be anything from using small amounts of the host's food to causing a fatal illness. The highest costs are paid in the tropics and sub-tropics where parasites present a continual and unacceptable threat to the well-being of millions of people. The cost of harbouring parasites in terms of human misery and economic loss is incalculable. Parasites are also a major cause of mortality and reduced reproductive success among domesticated animals and crops and one of the main concerns in agriculture is the control of parasites that can wipe out crops and livestock (Northrop-Clewes and Shaw, 2000).

On the other hand, intestinal helminths are multicellular pathogens that infect vast number of human and animal hosts, causing widespread chronic disease and morbidity (Crompton and Nesheim, 2002). Poor people in developing countries endure the burden of disease caused by four common species of soil transmitted nematodes that inhabit the gastro-intestinal tract namely *Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale* and *Necator americanus* (Crompton and Nesheim, 2002). Children and pregnant women are the main sufferers from these parasitic infections (WHO, 2003). Among the effects associated with these parasites are growth retardation, intestinal obstruction, hepatic and biliary disease, impaired cognitive development, dysentery syndrome, fever, dehydration, vomiting and nutritional effects such as iron deficiency anaemia which can result to death of the victim. (Bundy *et al.,* 1990; Beers and Berkow, 1999; Bethony *et al.,* 2006). The parasites are more common in rural areas

in the developing countries of Asia, Africa and Central America and are often linked to poverty and other social problems such as poor sanitation and lack of clean water (WHO, 1998).

They are of major hazard because of their high prevalent rate and their effect on both nutritional and immune status of the population (Latham, 1984). In sub-Saharan Africa, intestinal helminth infections are common and of major health concerns because factors that predispose man to the infections such as poverty, poor sanitation, ignorance and malnutrition prevail (Ijagbone and Olagunju, 2006). Furthermore, the habit of playing on sand resulted in very widespread parasitism with a variety of helminths, and eating habits that involve the consumption of raw vegetables, fish, crustaceans and meat allow the transmission of helminths infections (Montressor *et al.,* 2002). The World Health Organization (WHO) estimates that more than one billion of the World's populations including at least 400 million school age children are chronically infected with soil-transmitted helminths (STH). Evidently, there is need for continuous evaluation of prevalence of intestinal infection among school children, since they seem most likely, the group at risk for constant infection. The global prevalence and number of cases of intestinal helminths infection in school age children have been estimated to be Roundworm 35% (320million); Whipworm 25% (233million); Hookworm 26% (239million), others 14% (128million) (Partnership for Child Development, 1999). The severity of the disease caused by soil-transmitted nematodes has consistently been found to depend on the number of worms present per person (Crompton and Nesheim, 2002). In Nigeria, various studies have been carried out to estimate the status of soil transmitted helminth infections (Oyewole *et al.,* 2007; Awolaja and Morenikeji, 2009; Osazuwa *et al.,* 2011) but there is paucity of report on intestinal heminthiasis among school children in Ekpoma, Edo State. Therefore, this study set out to assess the occurrence and intensity of intestinal helminth infections among the school children in the study area in order to serve as a guide for health planners in the state in evaluating worm control programmes among school children.

MATERIALS AND METHODS

STUDY AREA: The study was conducted at Ihumudumu Community, Ekpoma, the administrative headquarters of Esan West Local Government Area of Edo state. Epkoma lies between latitude 60 40^{0}N and 60 45^{0}N and longitude 60 05^{0}E and 60 10^{0}E (Obabori *et al.,* 2006). The inhabitants of Ekpoma

speak the language known as "Esan" and are predominantly teachers and farmers whose main produce are rice and cassava. Ekpoma was chosen because of its location, rainfall and occupation of its inhabitants and the standard of school buildings and environmental conditions commonly found. There are two distinct season in this area – the wet and dry season, the former takes place between April and October while the latter occurs from November to March. The analysis was carried out in diagnostic laboratory, college of medicine, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

ETHICAL PERMISSION: Prior to the collection of faecal samples, permission was sought from the headmasters of the chosen schools and class teachers of each class and parents/guardians of the pupils and Ambrose Alli University ethical committee, Ekpoma. This was granted and the pupils were educated on the causes of intestinal helminthiasis among school aged children. They were convinced that every child ought to be free from such infections, thus the necessity of participating in the research work was understood by them.

SAMPLE SIZE/SUBJECTS: Three hundred and eighty (380) stool samples from children (181 males and 199 females) in two public primary schools in Ihumudumu community, Ekpoma, Edo, Nigeria, were used for this study. The schools involved, were Ihumudumu Primary School (250 pupils) and Isivbenelo primary school (130 pupils). Sample size was calculated using the formula below (Ekejindu *et al.,* 2002).

Sample size (N) = $\dfrac{Z^2pq}{d^2}$

Where N = The desired size
  Z = 1.96 (Standard Score)
  P = prevalence
  q = 1-p
  d = sample error tolerated (0.05).

SAMPLE COLLECTION. Specimen containers (wide-mouthed screw capped plain plastic containers) were distributed to the children selected for the study with instructions slips on how and when the sample should be collected by parents/guardians. The specimen containers distributed were clean, dry, and leak-proof containers devoid of antiseptics and disinfectants as recommended by Cheesbrough (2006) and Odutan (1997). Each of the containers was labelled with the student's name, age and sex. The samples were received early the next morning from the schools after proper documentations. The samples were then transported immediately to the

laboratory for examination. Samples not examined early were preserved with 10% formol-saline.

EXAMINATION OF SAMPLES: The samples were processed in Diagnostic Laboratory, College of Medicine, Ambrose Alli University, Ekpoma, Edo State, Nigeria. Each sample was examined macroscopically for colour, consistency and presence of constituents such as mucus, blood, pus, adult worms and worm segments. The consistency was used as a guide as to whether the egg or worm of the parasite is likely to be present. The samples containing mucus and blood were examined first followed by watery samples (Cheesbrough, 2006). Microscopically, the faecal samples were first examined for helminth eggs by direct wet smear methods. This was done by emulsifying small quantities of the faeces in normal saline and examining microscopically under cover slip. Further examination of the faeces was done by concentration method using the formol-ether concentration technique. This was carried out by adding 3ml of diethyl ether to sieved suspension of emulsified faecal sample in 7ml of 10% v/v formol saline. The preparation was further processed as recommended by Cheesbrough, 2006. Eggs of intestinal helminths observed were identified by reference to the book "Diagnosing helminthiasis through coprological examination by Thienpoint *et al.* (1979) and Soulsby, (1982)."

DATA ANALYSIS: The data obtained were analyzed using Chi-square statistical tool. The differences were considered to be statistically significant at *P*-value less than 0.05.

RESULTS

Of all the samples, 71 (18.7%) were found to be infected with one or two intestinal helminths. 67 (17.6%) were infected with only one helminth while 4 (1.1%) were infected with two different helminths - Hookworm and *A. Lumbricoides* 2(0.5%), Hookworm and *E. vermicularis* 1(0.3%), and Hookworm and *T. Trichiura* 1(0.3%). Seven different species of helminths were recorded; with Hookworm having the highest prevalence rate 32(8.4%), followed by *Ascaris lumbricoides* 13(3.4%), *Trichuris trichiura* 10(2.6%), *Enterobius vermicularis* 4(1.1%), *Strongyloides stercoralis* 3 (0.8%), *Schistosoma mansoni* 3(0.8%) and *Fasciola spp*. 2(0.5%). The single and multiple distribution patterns of the helminths are shown in Table 1.

Table 2 shows the prevalence of intestinal helminths infections by age and sex in the study. Females were

found to be more infected than males with prevalence rates of 19.1% and 18.2% respectively but the difference was not statistically significant (X^2 =0.352, X^2tab.=0.455, p =0.552; p>0.05) with 1 degree of freedom. The prevalence rates of infection in both males and females peaked in the age group (10-14) years with 19.1% and 19.4% respectively. In all, children in the age group 10-14 years were found to be more infected (19.3%) than age group 5-9 years (15.5%) with the difference statistically significant (X^2 =39.563, X^2tab.=10.827, p =0.00; p<0.05) with df =1.

Table 3 shows the prevalence of intestinal helminth infections by age and sex in Ihumudumu primary school. Forty-five (18.0%) of the 250 pupils investigated were found to be infected with one or two intestinal helminths. There was no statistical difference in the prevalence of infection between the males (18.0%) and the females (18.0%), i.e sex: (X^2 =0.022, X^2tab = 0.064, p =0.882; p>0.05) with d=1. The prevalence rates of infection in both males and females peaked in the age group (10-14) years with (19.3%) and (19.8%) respectively. Children in the age group of 10-14 years (19.6%) were found to be more infected than those in age group 5-9 years (6.7%) but the difference was statistically significant (X^2 =37.356, X^2tab.=10.827, p =0.00; p<0.05) with df=1.

Table 4 shows the prevalence of intestinal helminths infections by age and sex in Isibhenelo primary school. 26(20.0%) of the 130 pupils investigated were found to be infected with one or two intestinal helminths. Females were found to be more infected than males with prevalence rates of 20.8% and 18.9% respectively but the difference was not statistically significant (X^2 =1.385, X^2tab.=10.827, p=0.239; p>0.05) with df =1. The prevalence rates of infection in both males and females peaked in the age group (5-9) years with 20.0% and 27.8% respectively. Children in the age group 5-9 years (25.0%) were found to be more infected than those in age group 10-14 years (18.6%) and the difference was statistically significant (X^2 =5.085, X^2tab.=5.412, p =0.02; p<0.05) with df =1.

Table 5 shows the prevalence of intestinal helminths infections according to the two schools examined. In Ihumudumu primary school, 45(18.0%) out of the 250 pupils investigated were found to be infected with one or two intestinal helminths. 43(17.2%) of the pupils were infected with single helminth infections while 2(0.8%) of the pupils were infected with mixed infections. In Isibhenelo primary school, 26(20.0%) of the pupils investigated were found to be

infected with one or two intestinal helminths. 24(18.5%) of the pupils were infected with single helminth infections, while 2(1.5%) were infected with mixed infections.

The prevalence rates of helminths infections was however higher in Isibhenelo primary school (20.0%) than in Ihumudumu primary school (18.0%) and the difference was statistically significant (X^2 =5.085, p =0.024; p<0.05) with df=1.

Table 1: Single and Multiple Distribution Patterns of the Helminths.

Helminths	N=380	No infected	% of infection
Single	Hookworm	32	8.4
	Ascaris lumbricoides	13	3.4
	Trichuris trichiura	10	2.6
	Enterobius vermicularis	4	1.1
	Strongyloides stercoralis	3	0.8
	Schistosoma mansoni	3	0.8
	Fasciola spp	2	0.5
	Total	**67**	**17.6**
Multiple	Hookworm + *A. Lumbricoides*	2	0.5
	Hookworm + *E. vermicularis*	1	0.3
	Hookworm + *T. Trichiura*	1	0.3
	Total	**4**	**1.1**
Overall Total		**71**	**18.7**

Table 2: Prevalence of Intestinal Helminths Infections by Age and Sex in the Study.

Age group (Years)	Male		Female		Total	
	No examined	No infected (%)	No examined	No infected (%)	No examined	No infected (%)
5-9	24	3(12.5)	34	6(17.6)	58	9(15.5)
10-14	157	30(19.1)	165	32(19.4)	322	62(19.3)
Total	**181**	**33(18.2)**	**199**	**38(19.1)**	**380**	**71(18.7)**

Sex: (X^2 =0.352, X^2tab. =0.455, p =0.552; p >0.05) df =1; Age: (X^2 =39.563, X^2tab. =10.827, p =0.00; p <0.05) df =1

Table 3: Prevalence of Intestinal Helminths Infections by Age and Sex in Ihumudumu Primary School, Ekpoma.

Age group (Years)	Male		Female		Total	
	No examined	No infected (%)	No examined	No infected (%)	No examined	No infected (%)
5-9	14	1(7.1)	16	1(6.3)	30	2(6.7)
10-14	114	22(19.3)	106	21(19.8)	220	43(19.6)
Total	**128**	**23(18.0)**	**122**	**22(18.0)**	**250**	**45(18.0)**

Sex: (X^2 =0.022, X^2tab. =0.064, p =0.882; p >0.05) df =1; Age: (X^2 =37.356, X^2tab. =10.827, p =0.00; p <0.05) df =1

Table 4: Prevalence of Intestinal Helminths Infections by Age and Sex in Isibhenelo Primary School, Ekpoma.

Age group (Years)	Males		Females		Total	
	No examined	No infected (%)	No examined	No infected (%)	No examined	No infected (%)
5-9	10	2(20.0)	18	5(27.8)	28	7(25.0)
10-14	43	8(18.6)	59	11(18.6)	102	19(18.6)
Total	**53**	**10(18.9)**	**77**	**16(20.8)**	**130**	**26(20.0)**

Sex: (X^2 =1.385, X^2tab. =1.642, p =0.239; p >0.05) df =1; Age: (X^2 =5.538, X^2tab. =5.412, p =0.02; p <0.05) df =1

Table 5: Prevalence of Intestinal Helminths Infections According to the Two Schools Examined

Schools	No examined	No with single infection (%)	No with mixed infection (%)	Total No infected (%)
Ihumudumu	250	43(17.2)	2(0.8)	45(18.0)
Isibhenelo	130	24(18.5)	2(1.5)	26(20.0)
Total	**380**	**67(17.6)**	**4(1.1)**	**71(18.7)**

(X^2 =5.085, X^2tab. =5.412, p =0.024; p <0.05) df =1

DISCUSSION

The relatively low prevalence observed in this study contradicts reports from previous local studies where higher prevalence ranging from 33.6% to 74.8% for rural communities (Arinola and Fawole, 1995; Meremikwu *et al*., 1995; Zoakah *et al*., 1999; Ibrahim *et al*., 2000). These variable results in prevalence are reflection of local endemicity and sanitary conditions, poverty, overcrowding, health habits, timing and seasonal differences in the design of the survey work and personal hygiene of the people (Albonico *et al*., 1999). In Nigeria, these factors are present in both rural and urban communities. Rural children may be considered to be at relatively higher risk than urban children, because these risk factors are more pronounced in rural than urban centres. The overall outcome of this study however, contradicts the fact above and similar for urban pupils reported by Wagbatsoma and Aimiuwu, 2008, who recorded a similar lower prevalence rate

of 21.1% among school children in Egor Local Government area in Benin City, Edo, Nigeria. The low prevalence does not appear to be due to good personal hygiene among the pupils, but may be related to routine use of anti-helminthic drugs. Mass de-worming campaign by Government as well as the incorporation of anti-helminthic drugs into the maternal and child health (MCH) programme by the Federal Government may account for this. The majority of infested cases seen probably represented re-infested cases or those who for one reason or the other had not used anti-helminthics.

Of the seven helminths detected in this study, Hookworm and *Ascaris lumbricoides* were the most prevalent, accounting for 45.1% and 18.3% of infections respectively among the pupils in the two schools. The other five parasites, *T. Trichiura, E. vermicularis, S. mansoni, S. stercoralis,* and *Fasciola spp*. were very low in prevalence. This pattern was in agreement with some studies (Gbakima *et al*., 1994; Musa, 1997) but at variance with others (Meremikwu

Edogiawerie *et al*., IJCR 2016; 5(1): 12 - 21.

16

et al., 1995). The relatively high prevalence of Hookworm compared to other parasites in this study might be due to climatic and environmental conditions of the community, such as poor water supply and poor sanitation facilities, which could be more favourable for Hookworm than the other worms. It may also be due to the presence of other unknown risk factors. Multiple infections were low in this study (1.1%). This may be related to frequent mass campaigns against helminth infection via community based distribution of anti-helminthic drugs in the state.

The female pupils (19.1%) had a relatively high prevalence rate than males (18.2%), but the difference is statistically insignificant (X^2=0.352, X^2tab.=0.455, p =0.552; p>0.05). Differences in infection between the male and female are occasionally reported, but more often than not, the prevalence of infection is either similar in both sexes (Anderson et al., 1993; Palmer and Bundy, 1995), and males have an edge over the female (Meremikwu et al., 1995; Curtale et al., 1998). However, few local studies have reported female sex having a higher prevalence than their male counterpart (Elekwa and Ikeh, 1996; Musa, 1997) but contrary to reports of Ukpai and Ugwu, (2003) and Ijagbone and Olagunju, (2006). It is however important to affirm that more female were enlisted for the study than males. The prevalence rate was decreasing with increasing age group possibly due to change in attitude, habits and more awareness regarding personal hygiene among the older school. Also, the female gender is more exposed to potential domestic sources of transmission of these helminths, like food preparation, fetching water, and disposal of waste than their male counterpart. However, the influence of gender on prevalence of helminthic infection is inconclusive as it may or may not play a role depending on the regional and environmental factors.

While other prevalence studies noted that the highest prevalence of intestinal helminths occurs in children aged 5-10 years (Gbakima et al., 1994; Arinola and Fawole, 1995). This study found that age specific prevalence rate was greater for age 10-14 years, and the difference is statistically significant; Age: (X^2 =39.563, X^2tab=10.827, p =0.00; p<0.05). This is particularly obvious among rural pupils. The reason why this age group is at the greatest risk of acquiring helminth might be due to frequency of host-parasite

contact as children in that age group would be expected to be able to assist their parents in domestic work like cooking and fetching water.

In Ihumudumu primary school, males and females had the same prevalence of 18.0%. This is in line with the reports of Uneke et al., (2007) and Adeyoba and Akinlabi, (2002) who reported 18.0% and 17.8% prevalence for males and females respectively in south-Eastern Nigeria from research work but disagree with the reports of Meremikwu et al., (1995) and Curtale et al., (1998) who reported that males have an edge over the female. However, age group 10-14 years (19.6%) was more prevalent than age group 5-9 years (6.7%) and the difference was statistically significant (X^2=37.356, X^2tab.=10.827, p =0.00; p<0.05) with df =1.

In Isibhenelo primary school, females were also seen to be more infected than males with prevalence of 20.8% and 18.9% respectively but the difference was not statistically significant (X^2 =1.385, X^2tab.=1.642, p=0.239; p>0.05) with df =1. With regards to age group, 5-9 years were more infected than age group 10-14 years with prevalence of 25.0% and 18.6% respectively, and the difference was statistically significance (X^2=5.238, X^2tab.=5.412, p =0.02; p<0.05) with df =1. This is in line with the reports Albonico et al., (2002) and Naish et al., (2004) who reported that age group 5-9 years is most responsible for contaminating the environment and also having contact with soil activity than 10-14 years.

The prevalence of intestinal helminths infections in different public primary schools were highest in Isibhenelo primary school (20.0%) than in Ihumudumu primary school (18.0%) and the difference was statistically significance (X^2 =5.085, X^2tab.=5.412, p =0.024; p<0.05) with df=1.Although studies have not been reported in this area of study but the environment of Isibhenelo primary school was very dirty coupled with dilapidated class rooms and water logged kind of field compared to Ihumudumu primary school that was renovated by the state government with modern facilities. Isibhenelo and Ihumudumu primary schools had single helminths infections of 18.5% and 17.2% respectively and mixed helminths infections of 1.5% and 0.8% respectively.

The presence of these intestinal helminths among these public primary school children in this study are is in accordance with the reports of Nwosu, (1981), Udosi, (1984), de Silver *et al*., (2003) and Brooker, (2006) who reported that the presence of these intestinal helminths infections in primary school children are as a result of poor environmental sanitation, low levels of living standards and ignorance of simple health promoting behaviour. From this study, it is observed that intestinal helminths infections are not prevalent among primary school children in Ihumudumu community, Ekpoma.

CONCLUSION

The present study reveals that intestinal helminths are relatively not abundant among the primary school children of Ihumudumu community, Ekpoma, Esan West Local Government Area, using age and sex of child as determinant of infection. To maintain this low prevalence and subsequently improve on it, the situation strongly calls for the institution of control measures, including treatment of infected individuals, improvement of sanitation practices, and provision of clean water.

RECOMMENDATIONS

Since intestinal helminthiasis is linked to socioeconomic in most African countries and its deleterious effects on the educational performance of school children, comprehensive investigation of intestinal helminths infections should not be limited to the children alone but also extend to their parents and other residents within a given community.

Mass deworming of school children with anti-helminthic drugs is required regularly to reduce the prevalence of infections.

Good personal hygiene must be encouraged by the teachers and adequate budget for provision of basic infrastructures should be made by government in the study area. The Use of dump-sites by children as sanitary facility should be discouraged and these children should also be taught basic health issues like washing of hands and wearing of shoes.

Also, portable water should be provided and improved sewage disposal should be put in place. These measures will not only increase the effectiveness of parasite control but also protect children from having other diseases associated with dirty environment such as cholera and typhoid fever.

REFERENCES

Adeyeba, O.A. and Akinlabi, A.M. (2002): Intestinal Parasitic Infections among School Children in a Rural Community, Southwest Nigeria. *Nig. J. Parasitol.* 17:17-21.

Albonico, M., Crompton, D.W. and Savioli, L. (1999). Control strategies for human intestinal nematode infections. *Adv. Parasitol.* 42:277-341.

Albonico, M., Ramsan, M., Wright, V., Jape, K., Haji, H.J., Jaylor, M., Savioli, L. and Bickle, Q. (2002): Soil-transmitted Nematode Infections and Membendazole Treatment in Mafia Island School Children. *Ann. of Trop. Med. and Parasitol.* 96: 717-726.

Anderson, T. J.C., Zizza, C.A., Leche, G.M., Scott, M.E. and Solomon, N.E. (1993): The distribution of intestinal helminth infection in a rural village in Guatemala. *Mem. Inst. Oswaldo Cruz.* 88: 53-65.

Arinola, O. and Fawole, O. (1995): Age and sex graded helminth infections in Nigerian village. *E. Afri. Med. J.* 72 (2): 110-112.

Awolaja, B.A. and Morenikeji, O.A. (2009): Prevalence and Intensity of Intestinal Parasites in Five Communities in South-West Nigeria. *Afr. J. Biotechnol.* 8(18): 4542-4546.

Beers, M.H. and Berkow, R. (1999): Parasitic infections. *The Merck Manual of Diag. and Thera.* 17:31 – 42.

Bethony, J., Brooker, S., Albonico, M., Geiger, S., Loukas, A., Diemert, D. and Hotez, P. (2006). Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *The Lanc.* 367 (9521): 1521-1532.

Brooker, S. (2006): The co-distribution of *Plasmodium falciparum* and hookworm among African schoolchildren. *Malaria. J.* 5:99.

Bundy, D.A.P., Wong, M.S., Lewis, L., Horton, J. (1990): Control of gastrointestinal helminthes by age-targeted chemotherapy delivery through schools. *Trans. of the Royal Soc. of Trop. Med. and Hyg.* 84: 115-120.

Cheesbrough, M. (2006): Intestinal Nematodes. In; District Laboratory Practices in Tropical Countries vol. 1. Low price edition. *Cambridge University Press, United Kingdom.* Pp. 184-215.

Crompton, D.W.T. and Nesheim, M.C. (2002): Nutritional Impact of Intestinal Helminthiasis during the Human Life cycle. *Annu. Rev. Nutr.* 22:35-59.

Curtale, F., Pezzotti, P., Sharbini, A. L., Al Maadat, H., Ingrosso, P. and Saad, Y.S. (1998): Knowledge, perception and behaviour of mothers towards intestinal helminths in Upper Egypt: implications for control. *Health Policy and Planning.* Oxford University Press. 13(4): 423-432.

de Silva, N.R., Brooker, S., Hotez, P.J., Montresor, A., Engels, D. and Savioli, L. (2003): Soil-transmitted helminth infections: updating the global picture. *Trends Parasitol.* 19(12):547-551.

Ekejindu, I.M., Ekejindu, G.O. and Agba, A. (2002): *Schistosoma haematobium* infection and nutritional status of residents in Ezi Anam, a riverline area of Anambra state, South Eastern Nigeria. *Nig. J. of Parasitol.* 23:131-138.

Elekwa, D. E. and Ikeh, E.I. (1996): A survey of the incidence of intestinal parasites amongst primary school children in relation to socio-economic factors in Jos, Nigeria. *Nig. Med. Practit..* 31(4): 60-62.

Gbakima, A.A., Sherpard, M. and White, P.T. (1994): Intestinal helminth infections in rural school children in Njala; Sierra Leone. *East Afr. Med. J.* 71(2): 792-796.

Ibrahim, M., Odoemena, D.I. And Ibrahim, M.T. (2000): Intestinal helminthic infection among primary school children in Sokoto. *Sahel Med. J.* 3(2): 65-68.

Ijagbone, I. F. and Olagunju, T. F. (2006): Intestinal helminthes parasites in school children in Iragbiji, Boripe local government, Osun state, Nigeria. *Afri. J. of Biomed. Research.* 9: 63-66.

Latham, M.C. (1984): Strategies for the Malnutrition and the Influence of the Nutritional Science. *Am. J. Clin. Nutri.* 10:5-31.

Meremikwu, M. M., Anita-obong, O. E., Asindi, A.A. and Ejezie, G. C. (1995): Prevalence and intensity of intestinal helminthiasis in pre-school chidren of peasant farmers in Calabar, Nigeria. *Nig. J. of Med.* 4 (2): 40-44.

Montressor, A., Awastshi, S. and Crampton, D.W.T. (2002): Helminth Control in School-Age Children. A Guide for Managers of Control Programs. *W.H.O. Geneva.* Pp. 53-75.

Musa, O.I. (1997): Intestinal helminthiasis among students seen during school entrance medical examination in Ilorin. *J. of Com. Med. and Prim. Health Care.* 9: 35-41.

Naish, S., McCarth, J. and Williams, G.M. (2004): Prevalence, Intensity and Risk Factors For Siol-transmitted Helminth Ifections in a South India Fishing Village. *Acta. Trop.* 19:177-187.

Northrop-Clewes, C.A. and Shaw, C. (2000): Northern Ireland Centre for Diet and Health and Applied Biological and Chemical Sciences, University of Ulster, Coleraine, County Londonderry, UK. *British Med. Bulletin.* 56 (No 1): 193-208.

Nwosu, A.B.C. (1981): The Community Ecology of Soil Transmitted Helminth Infection of Humans in Hyper-Endemic Area of Southern Nigeria. *Ann. of Med. and Parasitol.* 75: 197-203.

Obabori, A.O., Ebosele, R. and Mokidi, S.K. (2006): Decay Problems in Cities: Renewal Options. *JABS.* 4(1 and 2): 144-153.

Odutan, S.O. (1997): Housing and Health of Nigerian Children. *Trop. Govgr. Soc. Med. Parasitol.* 25:402-1044.

Osazuwa. F., Oguntade, M.A. and Imade, P. (2011): A Significant Association between Intestinal Helmints Infection and Anaemia Burden in Children in Rural Communities of Edo state, Nigeria. *North Am. J. Med. Sci.* 3(1): 30-34.

Oyewole, F., Ariyo, F., Oyibo, W.A., Sanyaolu, A., Faweya, T., Monye, P., Ukpong, M., Soremekun, B., Okoro, C., Fagbenro-Beyioku, A.F. and Olufunlayo, T.F (2007): Helminthic Reduction with Albendazole among School Children in Riverine Communities of Nigeria. *J. Rural Trop. Pub. Health.* 6:6-10.

Palmer, D.R. and Bundy, D. A. P. (1995): Epidemiology of human hookworm and *Ascaris lumbricoides* infections in rural Gambia. *East Afri. Med. J.* 72: 527-530.

Partnership for Child Development (1999): *A Situation Analysis: A Participatory Approach to Building Programs that Promote Health, Nutrition and Leaning in School* PCD, Oxford, UK.

Udonsi, J.K. (1984): *Necator americanus* Cross-sectional Study of Rural Community in Relation to some Clinical Signs. *Ann.of Trop. Med. and Parasitol.* 78:443-445.

Ukpai, O.M. and Ugwu, C.O. (2003). The Prevalence of Gastro-intestinal Tract Parasite in Primary School Children in Ikwuano Local Government Area of Abia State Nigeria. *Nig. J. Parasitol.* 240:129-136.

Uneke, C.J., Eze, O.K., Oyibo, P.G., Azu, N.C. and Ali, E. (2007): Soil-Transmitted Helminths Infection in School Children in South-Eastern Nigeria: The Public Health Implication. *Internet J. Third World Med.* 4(1):1-12.

Wagbatsoma, V.A. and Aimiuwu, U. (2008): Sanitary Provision and Helminthiasis among School Children in Benin City, Nigeria. *Niger. Postgrad. Med. J.* 15(2):105-111.

World Health Organisation (1998): It's a Wormy World. Geneva, *World Health Organisation (document WHO/CTD/SIP/98:4).*

World Health Organization (2003): Report of the WHO informal consultation on the use of praziquantel during pregnancy/lactation and albendazole/mebendazole in children under 24 months.

Zoakah, A.I., Idoko, L. O., Okonkwo, M.O., Adeleke, A.O. and Kpamor, Z. (1999): Intestinal helminthic infection and malnutrition in pre-school children in Utan Village, Jos, Plateau State. *Nig. Med. Pract.* 37 (6): 67-69.

World Health Organisation (1998): It's a Wormy World. Geneva, *World Health Organisation (document WHO/CTD/SIP/98:4).*

World Health Organization (2003): Report of the WHO informal consultation on the use of praziquantel during pregnancy/lactation and albendazole/mebendazole in children under 24 months.

Zoakah, A.I., Idoko, L. O., Okonkwo, M.O., Adeleke, A.O. and Kpamor, Z. (1999): Intestinal helminthic infection and malnutrition in pre-school children in Utan Village, Jos, Plateau State. *Nig. Med. Pract.* 37 (6): 67-69.

Thienpont, D., Rochette, F. and Vanparijs, O.F.J. (1979): Diagnosing helminthiasis through coprological examination. Janssen Research Foundation, Beerse Belgium.

Soulsby, E.J.L. (1982): Helminths, arthropods and protozoa of domesticated animals (7th edition), London. Bailliere Tindall (edt). Pp. 809.

AUTHOR'S CONTRIBUTION