

PREVALENCE OF *ANCYLOSTOMA DUODENALE* AND *TRICHURIS TRICHIURA* INFECTIONS AMONG PRIMARY SCHOOL CHILDREN IN A PART OF EBONYI STATE, NIGERIA

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ABSTRACT

Ancylostoma duodenale and *Tricuris trichiura* infections are among the leading causes of child morbidity in the developing countries like Nigeria. This cross-sectional study was carried out to determine the prevalence of these parasites among primary school children. Faecal samples from 175 pupils randomly selected from four primary schools in Onicha Local Government Area of Ebonyi State, were examined using direct microscopy and sodium chloride floatation techniques. A well structured questionnaire was used to obtain information from participants. Results showed overall prevalence of 14.9% for both parasites. *A. duodenale* was more prevalent (10.9%) than *T. trichiura* (4.0%). The highest prevalence of the parasites occurred in pupils between the age group 10-12 years (27.1%); pupils who used pond as source of water supply had prevalence of 24.5%; pupils who practiced bush defecation system had (16.0%) and pupils whose parents were farmers had (19.5%). There was no statistical relationship between gender, parents' occupation, location of schools and infection ($P > 0.05$). The implication of infection of the pupils with these parasites is a potential interference with the quality of their life. Provision of basic amenities such as portable water supply, standard toilets facilities in public places is recommended to help reduce the rate of transmission of the parasites.

Key words: *Ancylostoma duodenale*, *Tricuris trichiura*, children

INTRODUCTION

Ancylostoma duodenale and *Trichuris trichiura* are both common human intestinal parasites that pose public health threat globally. *Ancylostoma duodenale* is one of the most common species of hookworm (belonging to the family-Ancylostomatidae) which causes hookworm infection otherwise known as "anchylostomiasis" while *Trichuris trichiura* is a round worm (belonging to the family-Trichuridae) which causes "trichiuriasis" when it infects a human large intestine. They are worldwide in distribution but more endemic in areas located in tropical and subtropical zones (Loukas et al. 2004; Savioli et al. 1992; Izurieta et al. 2018). These worms lead a successful parasitic lifestyle once established within a host because there are no predators, plus regular supply of nutrients by the host's homeostatic

mechanisms (Hall et al. 2008).

A range of studies have shown that heavy infestation or presence of these parasites contributes to malnutrition in children, leading to growth retardation, loss of appetite and physical fitness, psychomotor development delay, which may impair the educational performance (Hall et al. 2008; Doni et al. 2015). The most serious result of these infections is the development of protein and iron-deficiency anaemia caused by blood loss which can be life threatening (Variyam and Banwell, 1982; WHO, 1990). When children are continuously infected by many worms, the loss of iron and protein can retard growth and mental development; and contribute significantly to the enteric disease burden experienced by these children (Nokes and Bundy, 1994; Miller et al. 2003; Loukas et al. 2004; Hall et al. 2008; Doni et al. 2014). Therefore, deworming campaigns

among school-age children with a single oral dose of mebendazole (500 mg) is expected to achieve more than 50% fecal egg count reduction (Izurieta et al. 2018).

Anchylostomiasis and trichiuriasis are both promoted by poor hygienic habits. Access to clean water, hygiene sanitation, proper washing of hands, vegetables and fruits have been identified as important in reducing the risk of acquiring helminthic infections (Izurieta et al. 2018). The global distribution of these intestinal parasites and the disease they cause have been documented by many authors (de Silva et al. 2003; Chan et al. 1994; Izurieta et al. 2018); and the prevalence and distribution differ from region to region due to several factors including geographical, social and environmental (Eneaya et al. 2003; de Silva et al. 2003; Agbolade et al. 2004; Loukas et al. 2004; Uneke and Udegbum, 2015). The estimation is that approximately a third of the global human population may be infected with helminthes (Mabbott, 2018) with highest risk of the infection among people living in tropical and subtropical regions of the world, and populations without access to reliable source of water and sanitation (Mabbott, 2018; Izurieta et al. 2018).

The degree of morbidity and clinical manifestations associated with worm infections is related to the intensity of the infection (Chan et al. 1994; Izurieta et al. 2018). Level of infestation and susceptibility may vary based on predisposing genetic factors in the human host (Izurieta et al. 2018). School-age children show higher prevalences of these infections most likely due to increased exposure to contaminated soil (Izurieta et al. 2018); as these diseases are usually acquired by ingestion of the infective eggs (Trichiuriasis) or by its penetration through the intact skin (Anchylostomiasis) (Despommier, et al. 1987; Miller et al. 2003; Hall et al. 2008; Izurieta et al. 2018).

Research works have been carried out concerning intestinal parasites in Nigeria (Adenusi and Ogunyomi, 2003; Agbolade et al. 2004; Odikamnor and Ike, 2004; Abah and Arene, 2015; Uneke and Udegbum, 2015). However, in Onicha Local Government Area

(L.G.A) of Ebonyi State Nigeria, there is paucity of information regarding prevalence of intestinal parasites and epidemiological data that shows factors that enhance susceptibility to the infections. The objective of this study was therefore to determine the prevalence of *Ancylostoma duodenale* and *Trichuris trichiura* infections among primary school children in Onicha L.G.A and some of the epidemiological factors that enhance susceptibility to the infections.

MATERIALS AND METHODS

Study Area:

The study was carried out in Onicha Local Government Area of Ebonyi State, which is geographically located at the South East Senatorial Zone of Nigeria. The climate of the area is tropical and the vegetation characteristic is predominantly the rain forest with an average annual rainfall of about 1300 mm and average atmospheric temperature of 30°C. There are two distinct seasons, the wet and the dry seasons, the former takes place between April and October, while the latter occurs from November to March. The area has streams and rivers which constitute the major sources of water supply to all the communities. Water contact activities like bathing, swimming, and washing are practiced in the area. Agriculture, especially swamp-rice cultivation and fishing are the main stay of the economy of the inhabitants.

Ethical consideration:

Approval for the study was obtained from the Chairman and Secretary Local Government Education Authority (LGEA) of Onicha LGA, Ebonyi State and from the Parents Teachers Association (PTA) of each school studied. Informed consent was also obtained from each participant before the collection of specimens. Pupils who refused participation were excluded from the study. Questionnaire data were coded to be anonymous such that it is not possible to identify individual patients. The three ethical principles of safety, privacy and confidentiality of participant's information were maintained.

Sample and sampling technique:

A total of 175 pupils were randomly selected from four schools located in four autonomous communities in Onicha L.G.A, including the males and females, from primary 1-6 within the age range of 4-15 years in each school, between August 2005 and June 2006. The pupils were mobilized with the assistance of their headmasters and teachers and were educated on the causes of intestinal parasite infections among children, the risk associated with living not de-wormed when infected and how to practice personal hygiene to avoid being infected. The samples were collected using wide mouthed corked sterile bottles. The serial numbers on the sample container were made to correspond with that on the questionnaires before distributing them to the pupils. With the help of the class teachers, the questionnaires were properly filled by interrogating each pupil according to the demographic information needed by the questionnaires including: name and age of pupil, class, parents' occupation, source of drinking water, defecation habit etc. The pupils were instructed on how to collect the stool sample into the containers, which were done in the school comfort places immediately after morning assembly between 8.00am and 9.00am. The samples were transported in a cold box from Onicha to the department of Medical Microbiology, Faculty of Clinical Medicine Ebonyi State University (EBSU) Abakaliki, where they were analyzed. The specimens which could not be examined immediately were preserved using 10% formalin (Cheesbrough, 2000), until they were examined.

Laboratory Analysis:

After macroscopically examining the stool sample for consistency, colour, presence or absence of blood and mucus, the microscopic examination was done. About 0.5g of each sample was placed at the center in a grease free slide and emulsified with drops of physiological saline and was covered with cover slip and viewed under the microscope with x10 and x 40 objective lens respectively. The stage of the g

microscopic was gradually moved up and down, sideways with moderate intensity of illumination for appropriate viewing (Cheesbrough, 2000). A saturated solution of laboratory sodium chloride was prepared in a conical flask. Clinical test tubes numbered according to the sample size for the day were arranged in a bench rack with 4 ml of the saturated salt solution; about 1g of each stool was emulsified in the numbered test tubes accordingly using applicator stick to crush properly and mix the sample with the solution. The test tubes were then filled with the saturated salt solution to brim and then carefully covered with clean cover slips, making sure that there was proper contact of cover slip with the suspension. The whole set up was allowed to stand for 20 minutes. The cover slips were then carefully removed and placed on clean numbered microscopic slides accordingly one after the other with subsequent examination of the slides under the microscope using x10 and x40 objective lens immediately. The fine adjustment of the microscope was used to examine every object in the field to search for the ova or larval stages of parasites.

Statistical Analysis:

Data collected using questionnaire were properly tabulated and analyzed to present the parameters studied. The differences between proportions were evaluated using Chi-square test. The values were statistically significant if $P < 0.05$.

RESULTS

Out of the 175 pupils tested, 26 (14.9%) had the helminthic infections, 19 (10.9%) pupils were infected with *Ancylostoma duodenale* while 7 (4.0%) had *Trichuris trichiura* infection. Among the four schools used for the study, Agbabor-Isu Community primary school (AICPS) had the highest percentage positive (20.0%), followed by Amanator and Mgbom central school (AMCS) (16.3.0%), Umuniko Community Primary School (UCPS) (11.6%) and then Amaeze Community Primary School (ACPS) (11.4%) Table 1.

Table 1: prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to location of school

Location/school	Total Number tested	Number positive (%)		Total Positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
AICPS	45	6 (13.3)	3 (6.7)	9 (20.0)
ACPS	44	4 (9.1)	1 (2.3)	5 (11.4)
UCPS	43	3 (7.0)	2 (4.7)	5 (11.6)
AMCS	43	6 (14.0)	1 (2.3)	7 (16.3)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: **AICPS** -Agbabor-Isu Community primary school, **UCPS** -Umuniko Community Primary School, **ACPS**-Amaeze community primary school, **AMCS** -Amanator and Mgbom central school. Key: Total positive= number positive for both parasites. Results are expressed as number positive (percent)

Among the various age groups studied, pupils between 10-12 years had the highest percentage prevalence (27.1%), followed pupils between 7-9 years (13.3%), pupils between 4-6 years (11.1%) and then pupils between 13-15 years (6.5%) Table2.

Table 2: Prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to Age of pupils

Age group	Total number tested	Number positive (percent)		Total positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
4-6 years	36	1 (2.8)	3 (8.3)	4 (11.1)
7-9 years	45	4 (8.9)	2 (4.4)	6 (13.3)
10-12 years	48	12 (25.0)	1 (2.1)	13 (27.1)
13-15 years	46	2 (4.3)	1 (2.2)	3 (6.5)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: Total positive= number positive for both parasites. Results are expressed as number positive (percent)

With respect to parents' occupation, pupils whose parents were farmers recorded the highest percentage prevalence (19.5%), followed by those whose parents were traders (16.3%), those whose parents were craftsmen (0.0%) and then those whose parents were civil servants (5.6%) Table 3.

Table 3: Prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to parents' occupation

Parents' Occupation	Number tested	Number positive (%)		Total Positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
Farmers	87	13 (14.9)	4 (4.6)	17 (19.5)
Civil servants	36	1 (2.8)	0 (0.0)	1 (2.8)
Craft men	9	0 (0.0)	1 (11.1)	1 (11.1)
Traders	43	5 (11.6)	2 (4.7)	7 (16.3)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: Total positive= number positive for both parasites. Results are expressed as number positive (percent)

With respect to gender, females were slightly more infected (15.2%) than males (14.6%) Table4.

Table 4: prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to gender

Gender	Number tested	Number positive (%)		Total Positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
Male	96	11 (11.5)	3 (3.1)	14 (14.6)
Female	79	8 (10.1)	4 (5.1)	12 (15.2)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: Total positive= number positive for both parasites. Results are expressed as number positive (percent)

With respect to sources of water supply, pupils whose source of water was pond had the highest percentage positive (24.5%), followed by those whose source of water was stream (18.2%), those that used well (16.2%) and then those that used bore hole (1.9%) Table5.

Table 5: Prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to sources of water of pupils

Water source	Total number tested	Number positive (%)		Total Positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
Pond	53	10 (18.9)	3 (5.7)	13 (24.5)
Stream	33	4 (12.1)	2 (6.1)	6 (18.2)
Well	37	5 (13.5)	1 (2.7)	6 (16.2)
Borehole	52	0 (0.0)	1 (1.9)	1 (1.9)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: Total positive = number positive for both parasites. Results are expressed as number positive (percent)

With respect to toilet system, those that use bush (15.9%) and then those that used the water system (8.0% (Table 6), followed by those that used the pit latrine

Table 6: Prevalence of *A. duodenale* and *T. trichiura* infections among primary school pupils in Onicha LGA with respect to toilet system

Toilet system	Number tested	Number positive (%)		Total Positive
		<i>A. duodenale</i>	<i>T. trichiura</i>	
Bush	106	13 (12.3)	4 (3.8)	17 (16.0)
Pit latrine	44	5 (11.4)	2 (4.5)	7 (15.9)
Water closet	25	1 (4.0)	1 (4.0)	2 (8.0)
Total	175	19 (10.9)	7 (4.0)	26 (14.9)

Key: Total positive= number positive for both parasites. Results are expressed as number positive (percent)

DISCUSSION

The result of this study showed that 14.9% of the pupils were positive for both parasites in Onicha LGA. Hookworm infection was more distributed in the area (10.9%) than *Trichuris trichiura* infection (4.0%). The report on the prevalence of the infections is in agreement with other similar studies (Eneaya et al. 2003; Abah, and Arene 2015; Uneke and Udegbunam, 2015), but however in disagreement with report of Agbolade et al. 2004, whose report showed the absence of *Trichuris trichiura* infection in their study. The prevalence of these parasites would have been enhanced by indiscriminate defecation practiced in the area, since questionnaire administration revealed that 60.6% of the pupils practiced indiscriminate and open defecation in the bush.

In this study, males had 14.6% prevalence while female had 15.2% prevalence. Prevalence of the two parasites was not sex-dependent ($P > 0.05$). This could be attributed to exposure of both sexes to practice such farming that enhances susceptibility to the infections. This is in conformity with a report of a similar study in some villages of Ijebu North, Ogun State Nigeria (Agbolade et al. 2004) and another study done in Rivers State, Nigeria (Abah, and Arene 2015). The presence of infection in all the age groups suggests that the problems of unhygienic practices and low standard of sanitation were not restricted to any age group in

the study area, however the highest prevalence (27.1%) recorded in age group 10-12 years and in the age group 7-9 years (13.3%) could be attributed to practices such as farming, fetching fire wood from the bush, fetching water from streams and ponds and defecation in the bush among the age groups, which are sometimes done barefooted due to carelessness, ignorance or poverty. Although pupils between the ages of 13-15 years should undoubtedly be involved in those practices that enhanced susceptibility, they unexpectedly recorded the least percentage prevalence (6.5%). This may be due to slightly higher hygienic practices among the age group. The percentage prevalence (11.1%) recorded among the age group 4-6 years, could be attributed to habits like eating food with dirty hands, eating unwashed fruits and vegetables and also walking bare footed and playing with soil. This is in tandem with other previous reports (Uneke and Udegbunam, 2015; Eneaya et al. 2003).

Although there were slight differences in the prevalence of the infections among the four schools used for the survey, there was no significant relationship between infection and location of schools ($P > 0.05$). This could be as a result of the same local topography and culture of the inhabitants of the area.

Pupils, whose parents were farmers recorded the highest prevalence (19.5%), compared to other pupils whose parents have other occupations. This could be ascribed to the

involvement of such pupils in farming activities, which are usually done barefooted; and practice of eating in the farm that are mostly done unhygienic. Those whose parents were traders had 16.3% prevalence, while those whose parents were craftsmen had 11.1%; this could be attributed to hawking by the children which is common among traders and craftsmen and are sometimes done barefooted, in addition to the fact that most traders are so much committed to their businesses that they have little or no time to guide their children on good hygiene practices. Those whose parents were civil servants had the lowest prevalence of 2.8%; this may be due to increased hygienic practices among civil servants as a result of higher level of literacy and enlightenment among them, which undoubtedly should reflect in their children. There was no significant, relationship between infection and water supply ($P > 0.05$).

Considering source of water supply, pupils that used borehole had the least prevalence (1.9%), this may be ascribed to the fact that borehole supply safer water than the other water supplies. Pupils whose sources of water were pond, stream and well, had the prevalence 24.5%, 18.2% and 16.2% respectively. These prevalences are higher compared to 1.9% recorded among pupils with borehole as source of water. This shows that sources of water might have a role to play in predisposition to intestinal parasitic infection. This is in agreement with the report of Ani and Akamnonu, (2009). This could be due to contamination probably by rainfall percolating through sewages or dumps into such water bodies which could contain infective form of the parasites and may enhance fecal-oral transmission, or fetching water barefooted from such water sources.

With respect to toilet system, pupils who use the bush had the highest prevalence (16.0%), while those that used water system had the least prevalence (8.2%). This may be due to unhygienic practice during defecation. This is consistent with report from a similar study (Ani and Akamnonu, 2009). There is no significant relationship between toilet system and infection ($P > 0.05$).

The limitation of this study is that we did not pay attention to the presence of other intestinal parasites among the pupils in the study, which

may likely be present. We recommend a more extensive study on intestinal parasites using larger population size among the pupils in order to get a clearer picture of the burden of intestinal parasites in the study area.

CONCLUSION

A relatively low prevalence of *A. duodenale* and *T. trichiura* was observed among primary school children in Onicha L.G.A. of Ebonyi State, Nigeria. This study has demonstrated that intestinal parasites are prevalent in school-age children in developing countries like Nigeria. This study also suggests that source of water; toilet system and parents' occupation might have a role to play in predisposition to these parasites, or making them endemic. Provision of basic amenities such as portable water supply, standard toilets facilities in public places, mass literacy campaign and chemotherapy are recommended to help reduce the risk of exposure to these parasites.

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Conflict of interest:

The authors declare no conflict of interest.

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