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Full Length Research Article

Geohelminthiasis And Its Risk Factors Among Pupils in Unubi Community, Nnewi South Local Government Area

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ABSTRACT

Geohelminthiasis is a public health problem in Nigeria. This study was aimed at determining the prevalence and risk factors involved in the transmission of geohelminthiasis. A total of 250 pupils from seven primary (three public, two private, and two mission) schools in Unubi, Anambra State, Nigeria participated in the study from June to November 2023. A total of 250 stool samples were collected from pupils and analyzed using wet mount preparation and formol-ether concentration technique to detect positive samples. Information on pupils' risk factors for helminthiasis was elicited through questionnaires. Chi-square test was used to compare differences among variables at 95% confidence level. A total of 53 samples were positive for geohelminth eggs, giving an overall prevalence of 21.2% but only single infections with ova of *Ascaris lumbricoides* (12.8%), hookworm species 4.4%, and *Trichuris trichiura* 4.0% were encountered ($P<0.05$). Pupils aged 5-7 years recorded 30% prevalence while those 8-10 years recorded 18.3% ($P>0.05$). Males were more infected (22.5%) than females (19.6%) ($P>0.05$). Pupils from public schools had 30.6% prevalence and mission schools had 11.11% ($P<0.05$). This study highlighted potential health threats by geohelminths and calls for strategic deworming in the study area.

Keywords: Geohelminthiasis, prevalence, *Ascaris lumbricoides*, *Trichuris trichiura*.

INTRODUCTION

Geohelminths, otherwise known as soil-transmitted helminths (STHs) are a group of parasitic helminths causing infections to humans and domesticated mammals. STHs

are so called because they have a direct life cycle which requires no intermediate hosts or vectors in their life cycles, and are transmitted through contact with warm and moist soil contaminated with the parasite eggs or larvae **(**Holland and Kennedy, 2002**)**. Humans become infected with STHs by drinking unboiled water contaminated with the embryonated eggs, eating of raw or undercooked faecally-contaminated vegetables and other foods or licking fingers contaminated with infected faecal materials, as is the case with roundworms .The two hookworm species and *Strongyloides stercoralis* are transmitted through skin penetration by the infective filariform (L3) larvae. *Trichuris trichiura* is transmitted by the ingestion of its embryonated egg in contaminated food, water and finger during farm work. The common and well known five species of helminths responsible for widespread disease in humans include *Ascaris lumbricoides (*roundworms), *Trichuris trichiura* (whipworms), the two hookworm species *(Ancylostoma duodenale, Necator americanus)* and *Strongyloides stercoralis* (CDC, 2013).

Due to lack of information or insufficient attention to hygiene, infected individuals may contaminate their water supply with faeces. Insufficient water supply and sanitation facilities, over-crowded living environments, poor health care systems or inaccessibility to the health care systems and low levels of education have been reported to be responsible for predisposing the poor to infections and diseases, including the geohelminthiasis (de Silva *et al*., 2003). The warm and humid environment of the tropics is conducive for the survival of geohelminth eggs and larvae in the soil, as well as their hatching and embryonation (Aribodor *et al.*, 2019). Okon and Oku (2001) observed that geohelminths contamination arises from indiscriminate defecation on the ground, poor hygiene and sanitation. Socio-cultural practices such as the use of night soil for fertilizer contributes to the prevalence of intestinal helminth infections (Eneanya and Njom, 2003). Ugbomoiko *et al.* (2006) suggested that the habit of eating soil, known as geophagy and regularly biting or licking fingernails, drinking of well-or cistern-stored water could increase incidence of soil- transmitted helminths. Sam –Wobo *et al.* (2007) concluded in their study that, the unwillingness to pay for helminth treatment was a factor of ignorance and low economic profile of the community members. These are typical characteristics of many rural communities and urban slums in Nigeria. Other risk factors include failure to wear foot wears, having pools of water/sewage around houses (Ivoke *et al.,* 2017; Ojurongbe, 2012; Onuoha *et al.*, 2010; and Phiri *et al.,* 2000).

Geohelminths are major health problems of children of developing countries, being an important cause of morbidity in school-aged children especially primary school pupils (4 to 15 years), who harbour the highest intensity of worm infection (Adeyeba and Akinlabi, 2002). High intensity of STH infections among children impairs their physical growth, cognitive ability and development, and are a major cause of malnutrition and lack of essential micronutrients including iron deficiency anaemia, leading to poor school performance and absenteeism in children (WHO, 2017 and WHO, 2012). Researches and surveillance have shown that STH infection is still prevalent in Southeastern Nigeria particularly in Anambra State. According to Ekpenyong and Eyo (2008), the prevalence of intestinal helminth infections among school children in IgboEze South Local Government Area of Enugu State were 4.9 % infection with *A. lumbricoides*, 2.5 % with hookworm, and 0.7 % with *T. trichiura*. Ukibe *et al*. (2018) reported 22%, 14% and 6% prevalence of *A.*

lumbricoides, hookworm, and *T. trichiura* infections respectively in Nnewi North Local Government Area of Anambra State. Nzeukwu *et al*. (2022) stated that the prevalence of geohelminths in Awka South Local Government Area of Anambra State were 7.75% for *A. lumbricoides*, and 1.41% for hookworm infection. The study by Onyido *et al. (*2016) showed an overall prevalence of 21.7% of helminths infection, in which hookworm had the highest prevalence of 10.8% followed by *Ascaris lumbricoides* 5.83% among the primary school children in Nimo Community, Njikoka Local Government Area, Anambra State, Nigeria.

School-age children (3 – 15 years of age) harbour heavy intestinal parasites and thus are a good study group; they are the group most responsible for contaminating the environment and transmitting these infections (Albonico *et al.,* 2002). No documented research has been done to investigate the geohelminth infections among the primary school pupils in Unubi and their risk factors for the effective control of STH infections in the community. For effective control of STH infections, it is also important to understand the factors that influences transmission in an endemic area (Lustigman *et al*., 2012). Therefore, it is crucial to analyze the public's understanding, attitudes and perceptions about causes and sources of the infection. Hence, these form the basis for this study among primary school children in Unubi community, Nnewi South Local Government Area to provide baseline data that will aid in the implementation of mass drug administration and the execution of the global elimination program of soil transmitted helminthes in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted in Unubi, Nnewi South LGA in Anambra State from June 2023 to November 2023.The LGA has an average population of 218,717 inhabitants (Satellites.pro, 2024). Its latitude is 5º57′37″ N, longitude is 7 º2′29″ E, an average temperature of 26 degrees centigrade and an average humidity of 72 percent (Satellites.pro,2024) The total precipitation of the area is estimated at 2550mm of rainfall per annum and has several rivers flowing through its territories. Tropical rainforest is the kind of vegetation found there. Wet and dry seasons which respectively start from May to October and from November to April are the two seasons found in the study area. High temperature and high relative humidity are remarkable abiotic factors prevalent in the study area. The major economic activities of the inhabitants include handcraft, farming, trading and civil/public service.

Study Design

This was a cross-sectional study of the pupils in primary 1-6 from selected seven schools made up of three public, two mission and two private schools in Unubi Community. The study involved the collection and examination of faecal samples for detecting the diagnostic stages of STHs. The study also involved the determination of the various risk factors of the infection using questionaires.

Ethical Approval

Ethical approval was obtained from the ethical committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi (Ref No. NAUTH/CS/66/VOL.16/VER.3/302/2023/88). A letter of introduction was obtained from the Head of Department of Parasitology and Entomology Nnamdi Azikiwe University, Awka and taken to the Education Officer of Nnewi South Local Government Area and the school authorities

of the proposed schools for permission to work in the various schools. Advocacy visit was made to the selected schools before the study. Written consents of their parents were sought and the children whose parent or guardian consented to their participation in the survey were enrolled in the study.

Selection of Schools and Study Population

Seven primary schools made up of three public schools, two mission schools and two private schools were selected for the study namely: Asset American Godian School(AAGS), Christ the King Primary School(CKPS), Central Primary School(CPS), Community Primary School(COPS), Unity Primary School(UPS), Fidelity Primary School(FPS) and Joy Foundation Primary School(JFPS). The target population of the study was school-age children between 5 years and 13 years old who are pupils of primary schools in Unubi community, Nnewi South LGA.

Sample Size Determination

A total of 250 pupils were examined and the sample size was determined using Yaro Yamane formula for a finite population and pupils were drawn from each class. The formular is given as: $n = N/1+ N (e)^2$, where n = sample size, N= the finite population of each school, e= level of significance (0.05) and 1=unity(a constant) (Yamane, 1967).

Stool Sample Collection

A total of 250 labeled wide-mouthed screw-cap sterile stool bottles together with consent forms were distributed to the 250 school children from the seven selected schools. These were given for collection of their stool at home. The children were educated on the correct method of collecting stool samples. The labeling indicated the age, sex and unique identification number of each pupil. The stool specimens were quickly transported within an hour to the Parasitology Laboratory of Nnamdi Azikiwe University Teaching Hospital, Nnewi for analysis.

Laboratory Examinations of the Stool Specimens

Microscopic examination of the stool samples was done using Direct Smear and Formol Ether Concentration Techniques according to Cheesbrough (2009). The prepared slides were examined for helminth ova, worm or larvae using ×10 objective eyepiece to focus and ×40 objective for parasite identification.

Administration of Questionnaire

Simple but well-structured questionnaires were administered to extract information on the pupils' demographic data and the risk factors for STH transmission such as washing of fruits and vegetables, nail biting, playing with and eating of sand, hand washing practice, footwear usage, toilet usage, water source, their knowledge of geohelminthiasis, use of anti-helminthic drug, use of night soil in parents' farm, parents' education and occupation.

Data Analysis

Data analysis was done using the statistical package for Social Sciences (SPSS) version 2.5 for Chi-square test to determine significant associations between variables at 95% confidence level.

RESULTS

A total of 250 stool samples were examined, out of which 53(21.2%) tested positive for STH parasites while 197(78.8%) were negative. *Ascaris lumbricoides was* the most prevalent, 12.8%, followed by hookworm, 4.4% while *Trichuris trichiura* had the least prevalence, 4.0% (Table 1; Plate 1, 2, 3). There was significant difference in prevalence of the different parasites seen (P= 0.000). Of the seven schools studied, Unity Primary School, Unubi had the highest prevalence rate of 39.29% while Joy

Foundation Primary School, Unubi had the least prevalence of 5.56%. There was significant difference in prevalence among the individual schools (P= 0.005) (Table 1). More males, 22.5% were infected with STH than the females, 19.6%. There was no significant difference in prevalence between the gender (P= 0.587). The results of overall prevalence in table 4 above shows that the age group 5-7years had the highest overall STH prevalence of 30% while 8-10years, least prevalence of 18.3%.There is no significant difference in the prevalence of STH infections among the age groups (P=0.16) (Table 1).

Table 1: Species prevalence of STH infections according to schools, gender and age.

	Pupils' stool samples			**Species prevalence of geohelminth eggs**						
	Examined	Infected		*A. lumbricoides*		*T. trichiura*		Hookworm		**P-values**
	No.	No.	%	No.	%	No.	%	No.	%	
Parasites Seen	250	53	21.2	32	12.8	10	4.0	11	4.4	0.000
Primary Schools:										
AAGS	33	4	12.12	2	12.12	1	3.03	1	3.03	
CKPS	30	3	10.00	1	3.33	1	3.33	1	3.33	
CPS	41	10	24.39	6	14.63	3	7.31	1	2.44	
COPS	37	8	21.62	5	13.51	1	2.70	2	5.41	**0.005**
FPS	35	5	14.29	2	5.71	1	2.86	2	5.71	
JFPS	18	1	5.56	1	5.56	0	0.00	0	0.00	
UPS	56	22	39.29	12	21.43	1	1.79	9	16.07	
Total	**250**	**53**	**21.20**	**29**	**11.60**	**8**	**3.20**	**16**	**6.40**	
Gender:										
Male	138	31	22.46	17	12.32	4	2.89	10	7.25	**0.587**
Female	112	22	19.64	12	10.71	4	3.57	6	5.36	
Total	**250**	**53**	**21.20**	**29**	**11.60**	**8**	**3.20**	**16**	**6.40**	
Age group (years):										
5-7	60	18	30.00	13	21.67	4	6.67	1	1.67	
8-10	131	17	12.97	11	8.39	2	1.53	4	3.05	**0.160**
11-13	59	18	30.51	5	8.47	2	3.39	11	18.64	
Total	**250**	**53**	**21.20**	**29**	**11.60**	**8**	**3.20**	**16**	**6.40**	

A comparison of the prevalence of STH parasites among the public, mission and private primary schools showed that public schools had the highest prevalence 30.6% of STH infections, while mission schools had the least prevalence 11.11%. There was significant difference in prevalence among the school ownership (P=0.004) (Table 2).

From table 3 below, the results on risk factors obtained from the questionnaire showed that the highest STH prevalence was seen among pupils who do not wash their hands after defecation, 100%. The least prevalence of STH infections was seen among pupils whose parents had tertiary education, 0.30%. Based on the pupils' treatment attitude of STH infections, the highest STH prevalence was seen among pupils who do not use any drug (86.88%) and the least prevalence was seen among pupils who treated themselves with drugs from chemists. Based on their parents' education, pupils whose parents attended only primary school had the highest STH prevalence of 25.25% and the least prevalence was seen among pupils whose parents only attended tertiary institution,

0.30%. Based on their parents' occupation, pupils whose parents were farmers had the highest STH prevalence of 55.91%, while pupils whose parents were civil servants had the least prevalence of 25.0%. 28.7% had the basic knowledge of geohelminthiasis. Other risk factors associated with the transmission of STH infections among the pupils were the unhygienic practice geophagy, eating of unwashed fruits/vegetables, cutting of pupils' finger nails with their teeth, walking and/or working barefooted on potentially-contaminated soil, the use of night soil in parents'/school farms and not washing their hands after defecation which had STH prevalence of 40.9%, 22.22%, 34.4%, 11.6%, 11.9%, 25.0% respectively. There was significant difference in STH prevalence among all risk factors aforementioned but no significant difference in STH prevalence only among pupils who washed their hands before eating (P-value= 0.285) and pupils who walked/worked barefooted (P-value=0.131).

Table 2: Overall prevalence of STH infections according to schools ownership

	School Codes	No Examined	No Infected	Prevalence (%)	P-Value
Public	UPS COPS CPS	134	41	30.59	0.004
Mission	AAGS CKPS	63	7	11.11	
Private	FPS JFPS	53	6	11.32	
Total		**250**	**53**	**53.02**	

List of Plates

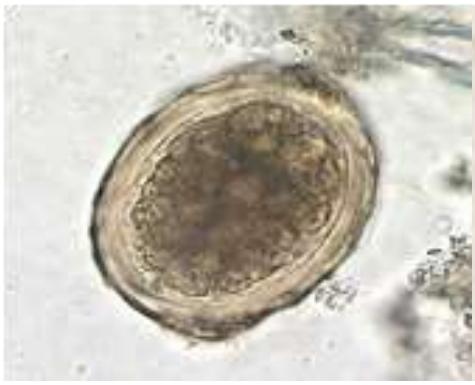


PLATE 1: Egg of *Ascaris Lumbricoides*



Plate 2: Egg of *Trichuris Trichiura*



Plate 3: Egg of Hookworm

Table 3: Risk factors associated with prevalence of geohelminth infection among pupils examined

Risk factors studied	Information from questionnaires		Pupils' stool samples with geohelminth eggs		P-Values
	Pupils responses	(No.)	(No.)	Prevalence (%)	
STH Knowledge	YES	143	41	28.67	0.001
	NO	107	12	11.21	
Hand-washing before eating	YES	17	10	58.82	0.285
	NO	96	43	44.79	
Hand-washing after defecation	YES	12	3	25.00	0.000
	NO	33	33	100.00	
Nail biting habit	YES	154	53	34.4	0.014
	NO	32	4	12.50	
Eating unwashed raw fruits and vegetables	YES	180	40	22.22	0.018
	NO	45	3	6.66	
Walking/working barefoot	YES	95	11	11.58	0.131
	NO	120	7	5.83	
Playing with/eating sand	YES	22	9	40.91	0.000
	NO	88	5	5.68	
Use of night soil in parents' farm.	YES	184	22	11.96	0.007
	NO	29	9	31.03	
Treatment attitude	Hospital/Health Centre	19	**8**	**42.11**	0.000
	Drug from chemists	**87**	**23**	26.44	
	Prayers	47	30	63.83	
	Use of herbs	124	52	41.94	
	No drugs at all	61	53	86.88	
Toilet use in schools	Water closet	0	0	0	0.000
	Squatter toilet	45	23	51.11	
	Pit	138	42	30.43	
	Open defecation	250	32	12.80	
Dewormed within last 3 months	YES	29	2	6.89	0.001
	NO	92	36	39.13	
Parents' educational level	Primary	198	50	25.25	0.043
	Secondary	205	32	15.61	

	Tertiary	10	3	0.30	
Parents' occupation	Farming	93	52	55.91	
	Trading	149	45	30.20	0.000
	Civil Service	12	7	58.33	

DISCUSSION

The results of the study showed that *Ascaris* infection was more prevalent and there was no mixed infections. Studies carried out in Nigeria and globally on soil-transmitted helminthiases have described ascariasis as the most prevalent, followed by hookworm infections and trichuriasis (Karshima 2018; Hotez and Kamath, 2009). This is similar to the findings of Ezeagwuna *et al*. (2009) who reported an overall prevalence of 48.08% in Ozubulu, 18% for *Trichuris trichiura*, 54.1% for *Ascaris* infection. Also, Aniwada *et al*. (2016) reported lower prevalence of STH infections in Enugu State of which *Ascaris* had a higher prevalence rate of 1.0%, 0.9% for hookworm and there was no mixed infection. The prevalence of STH infections in this study was low compared to previous studies done in Anambra state. For example, Iwueze *et al*. (2014) reported an overall prevalence of 60.4% in Nnewi South where hookworm had the prevalence of 29.1%, *Ascaris* with 22.1% and *Trichuris trichiura* with 4.6% prevalence. Chukwuma *et al*. (2009) in Ebenebe community reported high prevalence of 45.5% for hookworm, 18% for *Trichuris trichiura* and 54.1% for *Ascaris* infection. Aribodor *et al*. (2012) reported 46.5% prevalence for *Ascaris lumbricoides* infections, 40.4% for hookworm infections in a study carried out in Agulu, Adazi and Neni Anaocha Local Government, Anambra State. The findings of my research and that of others confirmed that STH infections are prevalent in Anambra State and are still a major problem in Nigerian environments. The results of this study does not agree with Uneke *et al*. (2006), who reported a lower overall prevalence of 16.9% in South Eastern Nigeria. The reported different prevalence of infection with geohelminths within the locations of these studies could be attributed to open defaecation practiced by the people and educational exposure of the inhabitants of the study area, their occupation, level of sanitation, economic status and infrastructural and health commodities and facilities at the disposal of the people of the study areas which worsened the STH prevalence.

This study showed that males were more infected with geohelminthiasis than the females. This may be due to the fact that males are more playful, which predisposes them to the infective stage of the parasites. This is in conformity with the study done by Odinaka *et al*.(2015) in Imo State which recorded prevalence of 38.4% for males and 21.1% for females, with the belief that male children are known to be more adventurous and playful. Nzeukwu *et al*. (2022) reported that the prevalence of STH infection according to gender indicated that males (11.8%) had more infection than females (8.1%) and stated that it could be because male children are usually more active and engage in outdoor activities more than the females. Previous study by Rwang *et al*. (2014) also recorded a higher prevalence of 25.0% among male school children in Obehie, Abia State. Also, Saka *et al*. (2013) reported that female and male pupils had a prevalence rate of 26.5% and 31.9%

respectively while Amaechi *et al*. (2013) also reported that the prevalence was also higher in males 82.0% than in females 71.4%. However, the report contrasts Anyaegbunam and Uwa. (2019) in their study of STH among school children who recorded a higher prevalence of 94.44% among females; and Chukwuma *et al*. (2009) who observed a higher prevalence of infection among female school children in Ebenebe, Anambra State. Aribodor *et al.* (2012) observed that the prevalence was higher in females than in males at 24.1% and 19.3% respectively in a study carried out in Agulu, Neni, Anaocha Local Government Area of Anambra State.

From the study, the prevalence of STH infection varied across different age groups. The age group 5-7years recorded higher prevalence rate of 30% than 8-10years and 11-13 with 18.3% and 18.6% prevalence respectively. Children of this age group are adventurous, tend to play in contaminated environment that could facilitate the transmission of STH and they are often less conscious of their personal hygiene. Similar findings were recorded by Ukpai and Ugwu (2003) in Anambra State that the age group 6-10years had more STH than other age groups. Also, Obiukwu (2008) recorded higher prevalence of 41% for age group 5-9years in Mbaukwu.

The high prevalence of *A. lumbricoides* , 12.8% reported in this study may be due to the high resistance of the infective ova to desiccation and the direct mode of infection that enhances longevity and promotes infectivity as reported also by Oluwole *et al*. (2018). It is in line with the study by Nzeukwu *et al*.(2022) who reported predominance of *Ascaris lumbricoides* (7.75%) as the most common helminth parasite observed and previous findings by Onyido *et al*. (2016); Ukibe *et al*. (2018) and Hassan *et al*. (2017) in Nigeria who reported *Ascaris lumbricoides* as the most prevalent helminth parasite in their studies.

The poor knowledge of the means of transmission and preventive measures for STH infections recorded in the study is similar to the report by Midzi *et al.* (2005) among grade three primary school children in Zimbabwe. The unhygienic, unwholesome and predisposing attitudes of the participants in this study have been reported by earlier studies on geohelminthiasis. Nmor *et al*. (2009) reported walking barefoot at regular and occasional levels as a significant predictor for hookworm infection in their study in Delta State, Nigeria and this is in line with the observation of this study. Ojurongbe *et al.* (2014) also reported barefoot as a problem in their study. Elam *et al. (*2018) reported that the practice of deworming at least twice yearly has been very poor in their study as only 2.75% of the children as at the time of the study dewormed twice per year, leaving 97.25% of them untreated. The scenario is similar to previous reports. Amaechi *et al.* (2017) reported that 81.7% of their study subjects in Abia State, Nigeria did not deworm themselves at six month intervals as at the time of their study. Geophagy, a habit that is prevalent among some Nigerian women, especially, the pregnant ones and infants could render people very susceptible to soil-transmitted helminth infections, especially in the tropics and the subtropics, where indiscriminate faecal disposal and other poor sanitation practices are carried out**.** Some pupils reported non-washing of hands, fruits and vegetables, this could serve as sources of infection since *Ascaris* eggs may be attached to the hand, fruits and vegetables and infection occur through faecal-oral route (Onyido *et al*., 2016). *Ascaris* eggs remain viable in the environment for a long time until ingested by humans. The health of the uninfected pupils is in jeopardy, considering the waste disposal pattern, prevailing

environmental factors in favour of maturation, development and subsequent transmission of geohelminths. Some of the listed risk factors have been reported by Uneke *et al.* (2012) as being characteristically important in shaping and propagating the transmission of geohelminthiasis among people in an endemic area.

School-by-school prevalence of infection indicated significant difference ($P<0.05$) across the schools. This could be attributed to the fact that the schools are located around different areas in Unubi and attended by pupils from families with different socio-economic class; with educational attainments, beliefs and exposure of their parents being also different.

Despite the fact that the Federal Ministry of Health (FMoH) in Nigeria has introduced regular deworming exercises using albendazole or mebendazole, geohelminthiasis is still high as to be considered a public health problem. It was observed from the study that insufficient public health awareness, ignorance, poverty, poor sanitation, neglect and inaccessibility to health and infrastructural facilities, are among the factors that maintain the transmission of STH infection in the study area and probably in other communities too. Little wonder geohelminthiasis are classified among neglected tropical diseases (NTDS), as they are endemic within disregarded and neglected population of people.

CONCLUSION

Although prevalence of STH is relatively low in this study area, control measures are still necessary. Adequate public health education, provision of sufficient sanitation facilities in the schools, and provision of effective and efficient well-monitored strategic deworming exercises is advocated for control of STH infections in the study area. There should be a follow up on the deworming exercise by the Ministry of Health to determine subsequently the status of geohelminthiasis in Unubi to avoid reinfection after mass drug administration.

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