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Prevalence of geohelminth in soil and primary school children in Panda Development Area, Karu Local Government Area, Nasarawa State, Nigeria

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Abstract

A study of geohelminthes infections among primary school children aged 8 to 13 years was conducted in four selected primary schools in Panda Development Area, Karu LGA, Nasarawa State, Nigeria. Out of four hundred and eighty (480) soil samples collected from the four schools, 314 (82.63) were found to be positive for eggs of four species of geohelminthes. The geohelminthes eggs/larvae encountered during the study include; *Ascaris lumbricoides* with 128 (26.67%), hookworm 84 (17.50%), *Strongyloides stercoralis* 63 (13.13%), and *Trichuris trichiura* 39 (8.13%). The highest prevalence of geohelminth eggs in soil samples was recorded in Panda Primary School 100 (83.33%) followed by Gitata Primary School with 97 (80.83%), while the least prevalence rate was recorded in Tattara Primary School with infection rate of 39 (32.50%). There was a significant difference in the distribution of geohelminthes in the study-areas ($p < 0.05$). However, out of the total of 480 stool samples analyzed, 260 (54.17%) obtained from males and 220 (45.83%) from females, 322 of the children were positive for one or more helminthes infections. The overall prevalence recorded was 67.08%. The study revealed the presence of only four geohelminthes in the infected stool samples analyzed; these include *A. lumbricoides* 127 (26.46%), Hookworm 108 (22.50), *S. stercoralis* 46 (9.58%) and *T. trichiura* 41 (8.54%). With respect to age-group, children under 5-7 years had the highest rate of infection with 149 (78.42%), while the least infection rate was recorded among 11-13 age-group with 66 (55.0%). Males had the highest infection rate of 167 (64.33%) while 155 (70.45) was recorded in females ($p > 0.05$). The study concludes that provision of modern toilet facilities, school based health programme and regular early deworming of pupils will go a long way in reducing infection.

Keywords: geohelminthes infection, primary school, parasites, children, Panda.

Introduction

Geohelminthes are soil-transmitted parasites where immature or undeveloped stages (eggs) require a minimum period of development or incubation in the soil before they become infective. The commonest and well known of such parasites are *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm, and *Strongyloidesstercoralis* [1]. The prevalence of infection with soil-transmitted parasites is approximately one billion people world-wide with school children being the most infected-group. It is estimated that over one billion people are affected with *Ascaris lumbricoides*, 800 million people with Hookworm, and 770 million people with *Trichuris trchiura* [2].

Varying prevalences had been recorded by reports

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in different parts of Africa for geohelminths [3, 4, 5 and 6]. Studies conducted by [7] in Indonesia showed a prevalence of *A. lumbricoides*, *T. trichiura*, Hookworms and *S. stercoralis* as 73.7%, 62.6%, 24.5% and 1.6% respectively from 2,394 stool samples examined. Geohelminth is the second leading cause of death among children < 6 years of age in Africa [2]. The infection is promoted by poor sanitary habits such as indiscriminate dumping or disposal of human and animal faeces. This habit permits contact of faeces and its accompanying microbial load together with geohelminth eggs with soil. Other risk factors include lack of safe water source, over-crowding, poverty, geophagia, failure to wear shoe, having pools of water and sewage around houses [8].

In Nigeria, a considerable amount of human and animal waste is discharged daily into the soil leading to the seeding of the soil with pathogenic organisms including geohelminth eggs and larvae [9]. Infection may be direct or indirect through secondary sources as food, water, vegetables and fruits since most geohelminth infections are acquired through the faecal-oral route. Observation in Zaria, northern Nigeria, by Nock *et al* [9] showed that 70% of the soil samples collected in a school compound was contaminated with geohelminth eggs showing the level to which the soil can be contaminated with faeces. Therefore this study evaluated the influence of soil as a risk factors of geohelminth infections among school children in Karu LGA, Nasarawa State, Nigeria.

Materials and methods

Study area

The study-area was Panda, Karu Local Government Area, Nasarawa State, Nigeria. The predominant people in the study-area are peasant farmers; some are civil servants, while others are business men and women. Nasarawa State lies between Latitude 7° 45′ N and 9° 25′N of the equator and between Longitude 7° and 9° 37′ E of the equator. According to National Population Commission (2006) the population of Nasarawa State during the 2006 National Population Census was 1,863,275. Nasarawa is within the savannah region of Nigeria, with rainy season usually from May to October and the cold dry season is within the months of November to April.

Collection and examination of soil samples

Four hundred and eighty (480) soil samples were collected thrice (i.e. Mondays, Wednesdays, and Saturdays) weekly from the compound of the four selected primary schools within the rainy season periods of 2008. Twenty-five grams of the top (down to a depth of not more than 3 cm) from the playground, front and behind classrooms and toilets areas were scoped into clean polythene bags using clean spoon and taken to the laboratory for analysis [9]. Seven (5) gram of each sample was placed in a tube containing formol water. This was homogenized for one minute. The suspension was then strained through wet cheese cloth placed over funnel to remove coarse sand particles. Ether was then added to the filtrate in a centrifuge tube and the mixture centrifuged at 2,500 rpm for 5 minutes. The supernatant was then decanted and the sediment placed on a clean glass slide, covered with a cover slip and then examined under the microscope using x10 and x40 objectives respectively. The ova and larvae of the parasites were identified with reference to parasitological Atlas [1].

Collection and examination of stool samples

Plastic bottles (wide-mouth) were given to 480 primary school pupils selected randomly. The pupils were allowed to take the bottles home and return same the next day (i.e. in the morning) to school with freshly passed stool samples. The name, age, and sex of each pupil were noted after the sample has been collected and labelled. The stool samples were then transported to the laboratory for analysis using formol ether concentration method or technique as indicated below:

Formol-ether concentration method or technique

With the help of an applicator stick (matches stick) 1 gram of the stool sample was emulsified thoroughly in 7 ml of 10% of formol ether contained in a 15 ml centrifuge tube. An additional 3 ml of 10% of formol-ether was again added to the centrifuge tube and homogenized. The emulsified stool was sieved and collected in a centrifuge tube. The suspension was then transferred to a centrifuge tube into which 4 ml of diethyl ether was added. The tube was stopper and mixed for 1 minute. The stopper was loosened and the tube was centrifuged at 1,500 rpm for 2 minutes. After centrifugation, the debris was loosened with an applicator stick and decanted along with the ether thereby leaving only the sediment at the bottom of the centrifuge tube. The bottom of the centrifuge tube was then clean with a swab and was then tapped to re-suspend and mix the sediment. The resultant sediment was then placed on a clean microscope glass slide, covered with cover slip and examined microscopically under x10 and x40 objectives respectively. The eggs were identified using Atlas of Parasitology [11].

Results

From the 480 soil samples collected from the four schools, 314 (82.63%) were found to be positive for eggs of geohelminthes. The geohelminthes eggs include; *A. lumbricoides* with 128 (26.67%), Hookworm 84 (17.50%), *S. stercoralis* 63 (13.13%), and *T. trichiura* 39 (8.13%). The highest prevalence of geohelminthes eggs in soil was recorded in Panda Science primary school 100 (83.33%) followed by Gitata Primary School 97 (80.83%), while the least prevalence was recorded in Tattara Primary School 39 (32.50%). Statistically, there was a significant difference ($p<0.05$) in the distribution of geohelminthes in the study communities (Table 1).

Of 480 stool samples analyzed, two hundred and sixty stool samples 260 (54.17%) were obtained from males and 220 (45.83%) from females. Out of a total of 480 stools collected and analysed, three hundred and twenty two (322) of the children were positive for one or more helminthes infections. The over all prevalence of infection was 67.08%.

The study revealed the presence of four geohelminthes in the infected stool samples analyzed; these include *A. lumbricoides*, hookworm, *S. stercoralis*and *T. trichiura* (Table 2). *A. lumbricoides* infection was the mostprevalent parasite among the pupils. Its prevalence though, decreased with age, and pupils within the age 5-7 years had the highest prevalence (78.42%) followed by age-group 8-10 years 107 (62.94%), while the least was found in age group 11-13 years 66 (55.00%). With respect to hookworm infection, the trend was not contrary to that of *A. lumbricoides* as the prevalence increased with age, with the highest prevalence of 55 (28.95%) in age group 5-7 years while subjects in age group 11-13 years had the least prevalence of hookworm 18 (15.00%). In the same way, the prevalence of *S. stercoralis* also followed similar trend with *A.lumbricoides* and hookworm while a disparity was recorded in *T. trichiura*in which the highest prevalence was recorded among the age-group 11-13 years 12 (7.50%) while the least was recorded among the age-group 8-10 years, 7 (4.18%) followed similar trend with hookworm. This study revealed a significant difference ($p<0.05$) with age group as shown in Table 3.

Table 4 showed the prevalence of geohelminthes with respect to gender. The results revealed that out of 260 male pupils examined, 167 (64.23%) were positive for geohelminthes. While out of the 220 female pupils examined, 155 (70.45%) were positive or infected with the parasites. There was no significant difference ($p>0.05$) in infection rate based on gender.

Table 1. The prevalence of geohelminths in soil samples collected from the four primary schools in the study-communities.

Parasites Isolated	No. of samples examined	Panda Infection (%)	Gitata Infection (%)	Tudu-uku Infection (%)	Tattara Infection (%)	Total Infection (%)
Ascaris lumbricoides	120	42 (35.00)	47 (39.17)	23 (19.17)	16 (13.33)	128 (26.27)
Hookworm	120	29 (24.17)	23 (19.17)	21 (17.50)	11 (9.17)	84 (17.50)
Strongyloides stercoralis	120	18 15.00)	19 (15.83)	16 (15.00)	8 (6.67)	63 (13.13)
Trichuris trichiura	120	11 (9.17)	8 (6.67)	16 (13.33)	4 (3.33)	39 (8.13)
Total	**480**	**100 (83.33)**	**97 (80.83)**	**78 (65.80)**	**39 (32.50)**	**314 (82.63)**

x^2 Cal = 30.13, x^2 Tab = 7.81, $df = 3$, ($p<0.05$).

Table 2. Prevalence of geohelminth eggs/larvae in stool samples of pupils analyzed.

Schools	No. of samples examined	No (%) of positive samples	*Ascaris lumbricoides* No (%)	*Hookworm* No (%)	*Strongyloides stercoralis* No (%)	*Trichuris trichiura* No (%)
Panda	120	92	33 (27.50)	25 (20.83)	23 (19.17)	11 (9.17)
Gitata	120	77	29 (24.17)	31 (25.83)	9 (7.50)	8 (6.67)
Tudu-Uku	120	86	39 (32.50)	28 (23.33)	6 (5.00)	13 (10.83)
Tattara	120	67	26 (21.67)	24 (20.00)	8 (8.00)	9 (7.50)
Total	**480**	**322 (67.08)**	**127 (26.46)**	**108 (22.50)**	**46 (9.58)**	**41 (8.54)**

x^2 Cal = 4.43, x^2 Tab = 7.81, $df = 3$, ($p>0.05$).

Table 3. Prevalence of geohelminthes by ages of pupils in the study areas.

Age (Yrs)	No. of samples examined	*Ascaris lumbricoides* No (%)	*Hookworm* No (%)	*Strongyloides stercoralis* No (%)	*Trichuris trichiura* No (%)	Total
5 – 7	190	64 (33.68)	55 (28.95)	21 (11.05)	9 (4.74)	149 (78.42)
8 – 10	170	50 (29.41)	39 (22.94)	11 (6.47)	7 (4.18)	107 (62.94)
11 – 13	120	27 (22.50)	18 (15.00)	9 (7.50)	12 (10.00)	66 (55.00)
Total	480	141 (29.38)	112 (23.33)	41 (8.54)	28 (5.83)	322 (67.08)

x^2 Cal = 6.68, x^2 Tab = 5.99, $df = 2$, ($p<0.05$).

Table 4. Prevalence of geohelminthes with respect to gender of the pupils in the study areas.

Parasites Isolated	Male n=260	Female n=220	Total Infection (%) n=480
Ascaris lumbricoides	55 (21.15)	54 (24.54)	109 (22.71)
Hookworm	47 (18.08)	49 (22.27)	96 (20.00)
Strongyloides stercoralis	40 (15.38)	33 (15.00)	73 (15.21)
Trichuris trichiura	25 (9.62)	19 (8.64)	44 (9.17)
Total	167 (64.33)	155 (70.45)	322 (67.08)

x^2 Cal = 0. 69, x^2 Tab = 3.84, $df = 1$, ($p>0.05$).

Discussion

Geohelminthes which is also known as soil-transmitted parasites present a great health predicament in several tropical and sub-tropical countries [12, 13, 14]. Infected school children are often physically and psychologically compromised by geohelminthes, leading to cognitive deficits, learning disabilities and high school absenteeism. It also leads to high morbidity, mortality and economic loss to the country [15]. Although intestinal protozoan cyst and other parasites were observed in this study, this was beyond the scope of this present study. The study further reconfirmed the triad patterns of *Ascaris*, hookworm, *strongyloides* and *trichuris* infections common in rural communities in Nigeria and Africa at large. Of all the soil geohelminthes observed, *A. lumbricoides* had the highest prevalence of 128 (26.67%) followed by hookworm with 84 (17.50%), while *T. trichiura* had the least prevalence of 39 (8.13) which was in contrast to the findings made among school children in a study by World Health Organisation (WHO) [16].

On the contrary, the prevalence in this study was higher compared to the findings of [10] who recorded a prevalence of 13 (5.9%) among primary school children in Ebenebe Town, Anambra State, Nigeria, this was because of poor sanitary conditions of the school environment. Also, the result of this study is in agreement with the prevalence recorded by Omah *et al* [17] who reported a prevalence of 286 (29.24%). This observation is expected because of the differences in study age-groups, sampling methods, environmental conditions, degree of dispersion of eggs, low sanitation as a result of indiscriminate defaecation and disposing of waste in the in school premises. Generally, this prevalence has been attributed by several authors to improper hygiene, poverty, poor sanitary conditions and agricultural habits, physical and chemical composition of the soil and degree of human exposure [18, 19].

Although the age-group 5-7 years had the highest prevalence of 149 (78.42%), the prevalence gradually decreased with the age of children. Children within this age-group of 5-7 years most likely expend more time playing with infected soil. They often eat indiscriminately sometimes with dirty hands. As they grow older, the children become more conscious of personal hygiene. So also there is development of resistance through improved susceptibility. The observation made in this study on age differences was in conformity with the findings in Abia, Osun and Ogun States of Nigeria [20, 21].

In this study, female had the highest prevalence of 155 (70.45%) compared to their male counterpart with about 167 (64.33%). There was no significant difference observed in infection among the gender-group ($p>0.05$). This further confirmed that activities such as walking bare-footed can predispose them to infections. The risk of eating soil (geophagy), licking of fingers and drinking well or tank water were significantly higher risks for *A. lumbricoides* and *T. trichiura* infections, and hookworm which was only associated with walking bare-footed.

Conclusion

Findings from this study revealed that four geohelminthes (*A. lumbricoides*, hookworm, *T. trichiura* and *S. stercoralis*) were common in Panda Community, Nasarawa State, Nigeria. This was a reflection of the poor state of hygiene and high rate of asymptomatic carriers in the community. Improved sanitation by provision of modern toilet facilities, health education by enlightenment campaigns, school-based health programme and regular early deworming of pupils would go a long way in reducing infection.

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