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Hookworm Infestation amongst Primary School Children in Enugu

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Abstract

Hookworm infestation was investigated amongst 273 primary school children from some random selected primary schools and a farming community, all in Enugu, Enugu State, South-East of Nigeria, between May and August 2008. The subjects were made up 110 (40.29%) males and 163 (59.71%) females. Stool samples 11 were collected from each subjects and examined macroscopically and microscopically for parasites using standard parasitological techniques. Out of 273 samples examined parasite 22 (8.06%) were positive for helminthic parasite and of this numbers of positives, ova of ascaris was 11 (50%), ova of hookworm 9 (40.9%), while mixed infection with ova of ascaris/hookworm was 2 (9.1%). The age group 5-years had the highest number of parasites in the population studied 11 (50%). Females recorded a higher incidence rate of 17 (77.27%) than males 75 (22.72%). The age groups and sex distribution of positives showed statistical significance difference ($p < 0.05$). Hookworm had a prevalence rate of 11 (4.0%) for single and mixed infection altogether. The age group 5-6 years had higher number of positives for hookworm, while females had the highest incidence rate for hookworm 9 (40.91%) than males 3 (13.64%). The difference in distribution of positive cases for hookworm between various age groups and sexes was statistically significant ($P < 0.05$). The present work has established the presence of hookworm infestation amongst primary school children in Enugu. The need for enlightenment of these primary school children on the importance of personal and environmental hygiene and practice is hereby stressed.

Keywords: Hookworm infestation; Enugu; School children

expense of the tissue and fluids of the host [1,2]. Parasites are divided into two Broad headings: Ectoparasites and Endoparasites. Ectoparasites includes: *Pediculus Humanus Capitis*.

Pediculus Humanus Humanus and Endoparasites includes protozoa parasites eg *Entamoeba histolytica*, *Gardia lamblia* etc, pletyhelminthic parasites such as *schistosoma spp.*, *Taenia spp.*, Nematohelminthic parasites such *Ascaris lumbricoides*, *Hookworm spp* (*Necator americanus*, *Ancylostoma duodenale*), *Trichuris trichuria* etc.

Parasitic diseases have contributed immensely in undermining the health status of people and jeopardizing the economic development of nations in the tropics [3].

Hook worm is an endoparasite, a nematode worm that lives in the small intestine of its host, which may be a mammal such as a cat, dog or human. It belongs to the phylum nematoda and family ancylostomatidae. Two common species of hookworm. *Ancylostoma duodenale* and *Necator americanus*, currently infect about 1.2 billion persons worldwide [4].

Hookworm infection is widely distributed throughout tropical and subtropical regions of the world. Favourable conditions for the spread of infection include warm temperature, high humidity, shade and contamination of human faeces [5].

It is estimated that up to one-fifth of the world's population is infected with hookworms. Humans harbor hookworm in their small intestine. The eggs are passed in faeces and will hatch within twenty-four to forty-eight hours were conditions are favourable. After hatching, the larva moults twice in soil and in approximately ten days, become infective filariform larvae. When a bare foot human walks in soil contaminated, with the infective larvae, it pierces the human skin, enter the blood stream and reach the lungs, break through pulmonary capillaries in to the alveoli and then tracheobronchial tree to the epiglottis. The larvae are then swallowed and reach the small intestine where they develop into adult worms. Eggs will appear in stool within one to three months of infection.

Introduction

Parasites are organisms which have adapted themselves to existence in, or on, another organism (the host) and live at the

Female worms will lay between 10,000 eggs per day for up to ten years [6].

Larval penetration of skin may cause local itching and papulovesicular rash, called 'ground itch'. In the lungs, there may be asthma-like symptoms or pneumonia.

In the intestine, hookworm uses buccal capsule to attach onto the small intestine and suck the blood of its host.

Symptom associated with hookworm infestation includes abdominal pain, diarrhea, weight loss, loss of appetite.

In chronic infections, the patients may become anaemic as the worms feed on the individuals blood. The loss of blood leads to loss of iron and protein, causing difficulty in breathing, pale complexion, tiredness, fast Heartbeat, generalized swelling and impotence.

Consequently there is slow growth rate, heart problems or even heart failure, cognitive performance in children and ultimately their educational achievement [7].

According to Odeunmi et al. [4], hookworm infection occurs both in adults and children but more common in children. This is because children are more likely than adults to come in direct contact with faecally contaminated soil containing infective larva.

Diagnosis is made by finding the characteristic eggs in stool. Treatment involves the elimination of the worm, correction of anaemia and protein deficiency if present. Medications that are effective against hook worm include albendazole, mebendazole etc.

Prevention of hookworm involves good sanitation systems and public education regarding the risks of contamination of soil with hookworms and importance of wearing shoes in endemic area [8].

As a result of the serious consequences and treats to health which hookworm infestation poses, this work is therefore embarked upon to ascertain the true position of the parasite in this part of the world with the following aims and objectives.

Aims and Objectives

- To investigate stool samples of primary school children from randomly selected primary schools in Enugu, for hookworm infestation.
- To determine the prevalence rate of this parasite in the children.
- To ascertain any age and sex preponderance of this parasite in the primary school children.

Materials and Methods

Study area

The study area was Enugu, in Enugu state, south east of Nigeria. Samples were collected from primary school children in some randomly selected primary school and from primary school children living in a farming community also in Enugu

between May and August, 2008. This includes Obiagu primary school; Army children school Gariki, Abakpa Nike Primary school, Ogui Nike primary school and primary school children living in Ugwu Aaron, a farming community.

Sample collection

Samples were collected from a total of 273 primary school children comprising of 100 male and 163 female. The children were aged between 5 and 13 year.

Children were provided with wide mouthed specimen bottles with screw caps and with specific instruction to collect sample in the morning. Information collected from the subjects includes age, sex, source of drinking water, type of toilets facility used etc through oral interpersonal interview.

Stool specimen collected from the patients was taken to the laboratory for analysis within one hour of collection.

Sample analysis

Macroscopic examination: This was carried out on stool samples, they include:

- Colour- Stool specimen as examine for their colour, whether they are brownish colored or dark in colour pale.
- Consistenc- whether it is formed, semi formed or watery.
- Visible content of stool whether it contains blood, mucus, pus, adult worms or tapeworm sediment.

Microscopic examination

Method used was according to Cheesbrough [9]. The microscopic examination of stool specimen for the presence of cysts, larva or ova was performed as follows:

Wet preparation (saline): A small amount of stool specimen was picked from various parts of a stool sample with aid of applicator stick and emulsified with one drop of normal saline. Cover slip and examined under microscope using $\times 10$ and $\times 40$ objective lenses for confirmation of ova of parasite.

Wet preparation (Lugol's iodine): Another silde was added lugol's iodine and small quantity of the stool sample was picked with an applicator stick and emulsified in it. This was covered with cover slip and examined microscopically with $\times 10$ and $\times 40$ objectives for identification of cysts.

Concentration techniques

This concentration was employed to isolate helminthes ova in case of scanty infection.

Brine floatation concentration: The test tube was filled to about $\frac{1}{4}$ with brine solution. A small amount of stool specimen was picked from various part of the stool sample with aid of applicator stick and emulsified in the brine solution. The test tube was filled to brim with brine solution and allowed to stand for ten minutes undisturbed. A coverslip was used to place on top of the test tube and this was vertically lifted up

with contents and placed on a slide. The contents were examined under a microscope using 10 X and 40 X objectives.

Ether concentration method: Formal ether concentration which is the most frequently used techniques because it concentrated a wide range of parasite with minimum damage to their morphology.

Using a rod or a stick, emulsify an estimated 1g of faeces in 4 ml of 10% formol water. Another 4 ml of formol water was added, mixed well by shaking and sieved the emulsified faeces, collecting the sieved suspension in centrifuge tube. 4 ml of diethyl ether was added, and the tube stopped and mixed for about 1 min. The suspension was centrifuge at 750-1000 g for 1 min. The segment collected on a grease free slide and was covered with a coverslip and examined using 10X and 40X objectives.

Results

Of the 273 stool specimens examined from the primary school children 22 (8.059%) were positive for parasitic infestations and of these numbers of positives, ova of hookworm 9 (40.9%) ova of *Ascaris* 11 (50%), while mixed infection with ova of *ascaris*/ova of hookworm was 2 (9.1%). The age group (5-6 years) had the highest number of parasites in the population rate of 17 (77.3%) than male 5 (22.7%), hookworm had an incident rate of 11 (4.0%) for single and mixed infection altogether. The age group (5-6) years had an incidence of hookworm 9 (40.9%) than males 3 (13.6%) (**Table 1**).

Table 1 Age and sex distribution of candidates studied in the entire population.

N=273			
Age Group	Number of		Total
	Males (%)	Female (%)	
5-6	24 (21.81)	29 (17.79)	53
7-8	29 (26.36)	42 (25.76)	71
9-10	25 (22.72)	41 (29.44)	66
11-12	31 (28.18)	48 (29.44)	79
13 And Above	1 (0.90)	3 (1.84)	4
Total	110 (40.29)	163 (59.70)	273

Table 2 shows the age and sex distribution of primary school children sourced from Ugwu Aaron community. Males 44 (39.286%) and female 68 (68.714%).

Table 3 shows prevalence of parasitic infestation in the entire population, out of the 273 specimens examined, 22(8.059%) of them tested positive for parasitic infections it was found that age group 5-6 year had the highest number of parasitic infection 11 (50%) to lowed by age group 9-10 years 6 (27.2%) and those of 7-8, 11-12 years 2 (9.091) and 12 and

above having the lowest number of parasitic infection, 4 (4.545%).

Table 2 Age and distribution of primary school children sourced from Ugwu Aaroon community.

N=112			
Age Group	Number of		Total
	Males (%)	Female (%)	
5-6	19 (16.96)	18 (16.07)	37 (33.03)
7-8	12 (10.71)	17 (15.17)	29 (25.89)
9-10	5 (4.46)	14 (12.5)	29 (25.89)
11-12	8 (7.14)	17 (15.17)	25 (22.32)
13 and above	0 (0)	2 (1.786)	2 (1.78)
Total	44 (39.28)	68 (60.71)	112 (100)

Table 3 Prevalence of parasitic infestation in the entire population studied.

N=273			
Age Group	Number of		Total
	Males (%)	Female (%)	
5-6	53	11	50
7-8	71	2	9.091
9-10	66	6	27.273
11-12	79	2	9.091
13 and above	4	1	4.545
Total	273	22	8.0586

Table 4 shows the prevalence of parasitic infestation in the entire population according to age sex. It was found that out of 22 positive parasitic, female had the highest number of parasitic infestation 17 (77.3) and male 5 (22.7%). There was a statistically significant difference between the distribution of male and females in the entire population ($p < 0.05$) there was no statistically significant different between the positive samples in the various age groups studied ($p < 0.05$).

However, there was a statistically significant different between the values gotten in the age group 5-6 and 9-10 from the other age groups studied ($p < 0.05$).

Figure 1 shows the incidence of parasites identified in the entire population studied.

It was found that hookworm had the highest incidence rate of 11 (50%) followed by *ascaris* 9(40%) and hook worm/*ascaris* 8 2 (9.1%).

Figure 2 Shows prevalence/distribution of hookworm identified from the entire population studied according to age and sex. Male 3 (25%) and female 9 (75%), there was

significant difference between the distribution of male and female in entire population ($p < 0.05$).

Table 4 Prevalence in parasitic infestation the entire population studied according to age and sex.

N=273			
Age group	Number of		Total
	Males (%)	Female (%)	
5-6	3	8	11 (50.00)
7-8	1	1	2 (9.09)
9-10	1	5	6 (27.27)
11-12	0	2	2 (9.09)
13 and above	0	1	1 (4.54)
Total	5 (22.72)	17 (77.27)	22 (8.05)

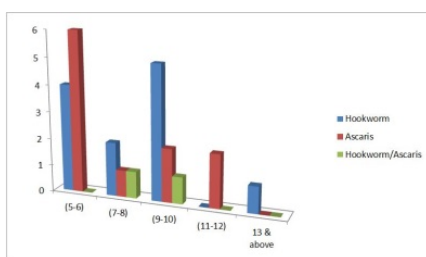


Figure 1 Shows prevalence/distribution of the various parasites identified according to age and sex in the entire population studied.

There was no statistical significant difference between the distribution of positive samples in the various age groups studies ($p > 0.05$).

However, there is statistically significant difference between the values gotten in the age group 5-6 and 9-10 from other age group studied ($p < 0.05$).

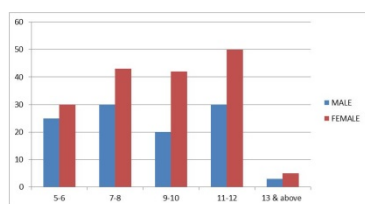


Figure 2 Prevalence/distribution of hookworm identified from the entire population studied according to age and sex.

Table 5 shows the prevalence/distribution of parasite identified at Ugwu Aaron community Versus hookworm identified from other primary schools studied out of the 22 positive samples, Ugwu Aaron had 20 (17.86%) and other primary school had 2 (1.24%).

There was statistical difference between positive samples in Ugwu Aaron 20 (17.86) and other primary school 2 (1.24%) ($p < 0.05$).

There was statistical difference between female 15 (13.39%) at Ugwu Aaron and those of other primary school 2 (1.24%).

Table 5 Prevalance/distribution of parasites identified at Ugwu Aaron community versus hookworm identified from other primary school studied.

Age group	Ugwu Aaroon N-12			Other Primary School N-2		
	Male	Female	Sub-total	Male	Female	Sub-total
5-6	3	7	10 (8.92)	0	1	1 (0.62)
7-8	1	1	2 (1.78)	0	0	0 (0)
9-10	1	4	5 (4.46)	0	1	1 (0.62)
11-12	0	2	2 (9.09)	0	0	0 (0)
13 and above	0	1	1 (0.89)	0	0	0 (0)
Total	5 (4.46)	17 (13.39)	20 (17.85)	0	2	2 (1.24)

Discussion

The study was carried out to investigate the prevalence of hookworm infestation in primary school children in Enugu. Out of 273 samples examined, 22 (7.3%) were positive, ova of Ascaris was 11 (50%), ova of hookworm 9 (40.9%), while mixed infection of ova of Ascaris/ova of Hookworm was 2 (9.1%). The prevalence of the hookworm in the entire population studied both in single and in mixed infection were 11 (4.0%).

Odeunmi et al. [4] recorded a higher prevalence of parasitic infection (8.4%), Infection among school children in Vom, Plateau state, Nigeria. This correlates to the prevalence rate recorded among primary schools children in this present study (8.06%).

This is also in agreement with the work done by Adenusi et al. [10], relative prevalence of the human hookworm species, *Necator americanus* and *ancylostoma duodenale* in urban community in Ogun state, Nigeria (28%).

From the present work, it seems that it was not the school the individual attains that mattered most but the environment the individual inhabits. In the different schools/areas studied, Ugwu Aaron community had the highest number of parasitic occurrence 20 (17.9%).

The examined subject revealed that all the community obtain their drinking water from the stream, 99% of them practiced indiscriminate and open defaecation, most of them go about bare-footed and this was likely to have expose them to infection by hookworm.

It was observed from this work that the age groups 5-6 years had the highest prevalence rate of parasitic infection

compared to other ages. This is not surprising because this is the age group in which children do a lot of playing without being conscious of personal hygiene.

Most of the children generally eat with dirty and unwashed hands most times especially after playing games. Moreso, most of them do not know the importance of washing their hands after defaecating and most of them keep some fairly long and dirty finger nails and since most of these intestinal helminthes are transmitted faeco-orally, the children are likely to easily contaminated themselves, either while eating or while biting these finger nails. This also agrees with the finding of Holland et al. [11]. The epidemiology of *Ascaris lumbricoides* and other soil transmitted helminthes in primary school children from Ile-ife, Nigeria, who observed that the bulk of helminth was within children and Beaver 1984 international Nematode in relation to age and sexes, who also observed that through all ages can be infected, but infection is more common among children than adults. As a rule, children carry the heaviest worm and egg burdens also because of their defaecation practices and their low level of personal and environmental hygiene they are principal disseminators of infection.

From this present work it shows that females are more infected by both *Ascaris Lumbricoides* and hookworm than the male counter parts. Considering the fact that these helminths are faeco-orally transmitted helminth, the high incidence rate of female infestation could be attributed to the fact that females engage themselves, more frequently with household jobs like, gardening, baby nursing and kitchen works, females grow vegetables more in faecally polluted farms where faeces are used as manure. They do this more than males who farm more of yam in cleaner farms. Young females also play a lot on soil more than young males and this is likely to be one of the reasons for higher incidence rate in the females.

This observation is similar to the World Bank's Development Report in 1993, investing in health which estimated that girls ages 5-14 in developed countries, intestinal worms account for 12% of the total disease burden than boys; that have a lower prevalence of 11%.

The higher prevalence of infection recorded among females (6.2%) than males (1.8%) agrees with the precious findings by Odebunmi et al. [4] on hookworm infection among school children in Vom, Plateau state, Nigeria, in which the prevalence of hookworm infestation was higher in females (6.5%) than in males (1.9%).

Conclusion

The present work has shown that intestinal parasites like *Ascaris* and hookworm are still infesting primary school

children. In Enugu, more especially in areas of where people have low level of personal and environmental hygiene (Ugwu Aaron), Hookworm infestation has been established in this present study both in primary school children at Ugwu Aaron and in the other primary school in Enugu.

This should be worrisome to the public because a range of studies has shown that iron deficiency can undermined the growth appetite and physical fitness of children and may impair their educational performance.

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