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GASTROINTESTINAL PARASITES OF SCHOOL CHILDREN IN BENIN CITY, NIGERIA

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Abstract

Examination of faecal samples of 6,430 school children aged between 2 and 20 years, for gastrointestinal parasites using sedimentation and Kato smear techniques was carried out in Benin city, Nigeria between January 1997 and December 1998. Four thousand two hundred and thirty six (65.8%) were infected. Three species of protozoans and 8 species of helminths were recorded as follows: *Entamoeba histolytica (6%), Entomoeba coli (4.8%), Giardia lamblia (5.2%), Schistosoma mansoni (2.4%), Fasciola gigantica (2.3%), Taenia sp. (1.3%), Ascaris lumbricoides (17.0%), Enterobius vemicularis (1.5%), Trichuris trichiura (6.8%), Necator americanus (13.9%), and Strongyloides stercoralis (3.9%).* Prevalence of infection increased with increase in age to a maximum value of 8.15% among the 6-9 years age group (junior primary pupils) and thereafter decreased with increase in age, to the least value of 28.6% among the 17-20 years old (senior secondary). The nursery pupils recorded the highest prevalence for protozoans and the nematode *Ascaris lumbricoides* infections while the senior primary pupils had the highest infection rates for the fluke *Schistosoma mansoni* and for all other nematode parasites recorded (apart from Ascaris). The junior secondary pupils recorded the highest prevalence for the liver fluke, *Fasicola gigantica* while the senior secondary pupils recorded the least prevalence for all the parasitic infections. Infections were significantly high ($P<0.05$) in the rainy season (April-October) and low in the dry season (November-March). The high infection rate is considered to be due to general poor sanitation in the environment and the poor sanitary habits of children.

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Introduction

Benin city (6.17-6.26°N and 5.35-5.41°E) lies in the tropical rain forest belt and has an annual rainfall of between 1850-2445 mm. The city is the capital of the ancient Benin Kingdom as well as that of the present day Edo State of Nigeria.

Parasitic infections in children are generally major health problems and affect the growth and development of children (17,19). Several studies have been carried out to determine the prevalence of parasitic infections among children in various parts of Nigeria (1,6,7,14,15,20). These studies reported differences but high prevalence of infections.

In Benin city, which is a fast developing metropolis with its crowding population, only a few studies have been carried out and include the studies on parasitic infections among hospital patients of Specialist Hospital (11), Benin city, and on some human gastrointestinal parasites in various geographical areas of the Bendel State with Benin City as the capital(12). Recently, the intestinal helminthiasis among the 7-12 years old school children in Benin city was reported (17).

The City experiences heavy flooding particularly during the rainy season and in addition there are sanitation problems due to inadequate sewage and refuse disposal all of which (22,23) can contribute to proliferation and spread of environmental parasitic infections.

The present report is therefore a study of the prevalence, intensity, age group, sex and seasonal pattern of parasitic infectious (both protozoans and helminths) among nursery, primary and secondary school children all between 2 to 20 years of age in the various parts of Benin metropolis.

Materials and methods

Stool samples were obtained from a total of 6,430 school children (comprising of nursery, primary and secondary pupils) from 20 schools within the

10 major zones (i.e. 2 schools per zone). From each zone between 25 and 28 pupils were examined monthly (i.e. a total of between 250 and 280 pupils examined monthly from the 10 zones) from January 1997 to December 1998. Thus a total of between 620 and 650 pupils were examined from each zone during the study.

The stool samples were collected using specimen bottles containing 5ml of 10% formol saline for preservation. Apart from supplying the faecal sample, the students were made to answer certain questions in a previously tested questionnaire to obtain information on age, sex, weight, height, toilet facilities, sources of water, occupation of parents and other vital statistics used for the present and later studies.

Examination of the stool samples was by the direct smear method whereby 2mg of the stool sample was mixed with 5ml of 0.85% saline and thoroughly screened under the microscope after staining with iodine and eosin (10). Formalin-ether sedimentation method was also used by mixing 2mg of the faecal sample with 10ml of 10% formalin, centrifuged and examined for parasites (3). Also Kato smear method (9) was used particularly for estimation of the intensity of infection [calculated as number of eggs or cysts per gram (c.p.g. or e.p.g.) of faeces](9,14).

Some freshly obtained stool samples with eggs of parasites were also cultured in Dobell and Laidlow's medium and incubated at 37^0C for 5 days (10) for development of the eggs or cysts to aid the identifications. Generally, identifications of parasites eggs, cysts, larvae and adults were done with the aid of taxonomic keys (3,4,10,21,23). More positive identifications were obtained from samples sent to the International Institute for Parasitology, St. Albans and the British Museum in London.

Results

An overall 65.8% gastrointestinal parasitic infection rate was recorded in the children in Benin city. Of all the school children examined, prevalence of infection was highest (81.5%) among the junior primary pupils and least (28.6%) among the senior secondary pupils.

Children, whose parents are in the low income group recorded the highest prevalence for all parasitic infections than those with parents in the high income group. Significantly, high prevalence of infection ($P>0.5$) in the children was also associated with lack of proper toilets (49.8%), usage of water to clean

up after defecation (54.8%) regular play outdoors, bare footed (71%), non-taking of deworming drugs (65.5%), and living in densely populated areas, poor homes wih general poor sanitation (60.9%).

Parasite stages recorded were the cysts and trophozoites (for protozoans), the eggs (for trematodes, cestodes and some nematodes), the larvae (for the nematode, *Strongyloides stercoralis*) and the adults (on very few occasions for the nematodes *Ascaris lumbricoides* and *Enterobius vermicularis*). A total of eleven parasite species was recorded and consists of three species of protozoans, two species of nematode, one cestode species and five species of nematodes as shown in Table 1. Among the protozoan parasites, *Entamoeba histolytica* recorded the highest prevalence of 6.0% closely followed by, *Giardia lamblia* with 5.2% while *Entamoeba coli* recorded the least prevalence of 4.8% (Table 1). Among the helminths, high prevalence were recorded for *Ascaris lumbricoides* (17.0%) *Necator americanus* (13.9%) and *Trichiuris trichiura* (6.8%) while the tapeworm, *Taenia sp.* recorded the least prevalence of 1.3%. Other helminths recorded were *Schistosoma mansoni* (2.4%), *Fasicola gigantica* (2.3%), *Strongyloides stercoralis* (3.9%) and *Enterobius vermicularis* (1.5%).

The 6-9 years old age group recorded the highest prevalence (81.5%) followed by the 2-5 years old age group (79.5%) while the least prevlence of 28.6% was recorded by the 17-20 years old age group. Infection rates were seen to be decreasing with increase in age after the highest prevalence recorded by the 6-9 years old age group. Among the parasitic infections recorded, the highest prevalence values were seen among the 2-5 years age group (for protozoan and *A.lumbricoides* infections) the 10-13 years old age group (for *S.mansoni, T. trichiura, E. vermicularis, N. americanus* and *S. stercoralis*) and the 14-16 years old age group for *F.gigantica* and *Taenia sp.* (Table 1). These observed differences were statistically, significant ($P>0.05$).

Of the total 6,430 children sampled; 3,222 (50.1%) were males and 3,208 (49.9%) females. As shown in Table 1 , infections in males were generally higher (66.9%) than those in females (64.7%). Statistical analysis showed that the difference in overall prevalence of infection based on sex was not significant ($P>0.05$).

The intensities of protozoan infections were generally low (Table 2). *E. histolytica* recorded a maximum mean intensity of 253.1 ± 11.68 c.p.g. (Cysts

per gram of faeces).while *E.coli* recorded the least (124.7 ± 10.28 e.p.g (Cysts per gram of faeces). Among the helminths, intensity rates were moderate for A. *lubricoides* maximum mean intensity (MI) of 9258.4 ± 56.15 e.p.g. (eggs per gram of faeces)] *N. americanus* (maximum MI= 4,132.5± 38.46 e.p.g.) *T. trichiura* (maximum MI=2, 873.6 ± 49,52 e.p.g.) and *S.stercoralis* (maximum MI= 2, 518.3 ± 20.83 e.p.g.). For all other infections the intensities were low, the very least in intensity being *Taenia sp.* (maximum MI= 42.9 ± 8.34 e.p.g.) Generally, the intensities of infection vary directly with the prevalence.

Monthly prevalence of infection along with mean monthly rainfall pattern (Table 2) show that infection rates were usually high in the rainy season period (April to October) and low in the dry season period (November to March). Statistical tests of values recorded in the rainy season period show a significant difference ($P<0.05$) over values recorded in the dry season period.

Discussion

The overall high prevalence of 65.8% recorded in Benin city in the present study is comparable to 55.5% infection rate recorded in Okedigba, Kwara State (2) and 43.1% recorded in Akure, Ondo State (8). A much higher prevalence of 88.8% was earlier recorded for helminthiasis in Benin city (17) while 90% prevalence was recorded for gastrointestinal parasitic infection in lagos metropolis (20).

General poor sanitation and lack of modern infrastructure for basic healthy living have been blamed for this high prevalence of parasitic diseases in the cities (17,20). To buttress the above statement, the present study has clearly shown significant high infection rates in densely populated parts of the city where sanitation is poor whereas infection rate is low in the government reservation areas (G.R.A) with better environmental sanitation and healthy living conditions.

On the prevalence of infection according to the income level and social status of the parents, the result showed a high prevalence for the protozoans and nematode parasites among children of less enlightened parents in the low income group while chilren of enlightened and well-to-do parents in the high income gruop had the least prevalence for the same parasites. Children of parents in the average and middle income group , however , had the highest prevalence foı

S.mansoni, F.gigantica and *Taenia sp.* infections. Generally, children of parents in the low income group had the highest total prevalence of 54.1% while those whose parents are in the high income group had the lowest of 17.5% (Table 2,3).

On the factor of toilet facilities, a significantly high prevalence of 49.8% ($P<0.5$) was seen among children that live in places where people have to use surrounding bushes and hidden corners because toilets are lacking or very inadequate. The prevalence for all the parasitic infections decreased among those that use pit latrines (31.1%) and was least among children that use modern toilets with water closet (18.9%). Also on the factor of mode of clean up after defaecation, the prevalence of infection was highest for protozoans and nematodes parasites in children that use water to wash up their anus after defaecation (54.8%) and least for the same parasites among those that use toilet sanitary tissues (14.6%) (Table 2,3).

Strongyloides stercoralis and the hookworm *Nector americanus* infections can easily be acquired by walking bare-footed in infested dirty surroundings (21,22,23). With the huge successes recorded by Nigeria in recent years in the game of football by winning world championships, children in most urban towns (Benin city not left out) are frequently found playing the game bare footed everywhere available. Cleared refuse dump sites and undeveloped plots of lands are frequently used by children as playing grounds in the city. This could contribute to the increase in these nematode infections among children. Occurrence of *F.gigantica* eggs in stool of children (recorded in the present study) was also recorded in human stool in Benin city (11), who suggested that the parasites eggs in stool could have resulted from improperly prepared and consumed meat of infected liver or intestinal parts of cattle and other ruminants slaughtered in various abattoris in the city. This is because, cattle are already infected with *F.gigantica* before being brought to Benin city and other southern cities from the northern parts of the country (23). The parasite life cycle has

not been established in Benin city.

Schistosoma mansoni infection which also recorded low prevalence of occurrence may have been acquired from Ikpoba river or brought in from neighbouring rural localities since Benin city has pipeborne water supply. The low prevalence of *Taenia sp.* infections may be due to the traditional thorough method of cooking food before eating among the populance.

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Table 1- Parasitic infection in children of different age groups and sex in Benin city.

Parasites Recovered	Group of the parasite	Number of children infected in the various age groups															Total number infected
		Nursery 2-5 yrs old n= 1,400			Junior Primary 6-9 yrs old n=1,400			Senior Primary, 10-13 yrs old n=1,400			Junior Secondary 14-16 yrs old n=1,200			Senior Secondary 17-20 yrs old n= 1,030			
		M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	
1. *Entamoeba histolytica*	Protozoa	86	70	156	54	51	105	40	34	74	13	13	26	15	16	31	392(6.0%)
2. *Entamoeba coli*	Protozoa	54	52	106	46	63	109	33	42	75	15	9	24	-	-	-	314(4.8%)
3. *Giardia lamblia*	Protozoa	47	57	104	44	53	97	42	45	87	20	12	32	6	13	19	339(5.2%)
4. *Schistosoma mansoni*	Trematode Digenea	12	16	28	22	18	40	20	25	45	15	11	26	14	7	21	160(2.4%)
5. *Fasciola gigantica*	Trematode Digenea	2	4	6	11	7	18	20	18	38	30	23	53	25	14	39	154(2.3%)
6. *Taenia sp.*	Cestode	-	-	0	6	5	11	13	12	25	16	11	27	10	17	27	90(1.3%)
7. *Ascaris lumbricoides*	Nematode	225	217	442	185	154	339	89	84	173	51	64	115	15	13	28	1097 (17%)
8. *Enterobius vemicularis*	Nematode	-	-	0	13	19	32	19	18	37	17	12	29	-	-	-	98(1.5%)
9. *Trichuris trichiura*	Nematode	37	42	79	42	64	106	63	69	132	44	37	81	23	20	43	441(6.8%)
10. *Necator americanus*	Nematode	70	66	136	121	105	226	136	130	266	110	97	207	37	25	62	897(13.9%)
11. *Strongyloides stercoralis*	Nematode	27	29	56	28	30	58	41	41	82	20	13	33	14	11	25	254(3.9%)
		560	553	1113	572	569	1141	516	518	1034	351	302	653	159	136	295	4236(65.8%)

M = Males, F= Females, n = Sample size, Prevalence given in parenthesis. Total male infected = 2158 (66.9%) (n= 3222), Total female infected = 2078 (64.7%) (n= 3208)

Table 2- Monthly prevlence of the parasitic infection in children in Benin city from Jan. 1997 to Dec. 1997

Number of children Infected Monthly between Jan. 1997 and Dec. 1997												
Months	J	F	M	A	M	J	J	A	S	O	N	D
Mean rainfall (mm)	75	0	104	231	205	214	285	106	223	385	196	51
Population Sampled (n)	250	250	250	260	270	280	280	280	270	270	270	270
Parasite Species												
1.*Entamoeba histolytica*	-	2	6	17	21	25	28	26	25	27	12	10
2.*Entamoeba coli*	-	1	8	11	18	20	19	24	25	18	11	6
3.*Giardia lamblia*	3	13	15	5	16	15	13	20	19	14	13	10
4.*Schistosoma mansoni*	4	4	6	5	8	10	9	11	8	6	4	4
5.*Fasciola gigantica*	-	2	-	7	12	14	18	16	8	2	-	-
6.*Taenia sp.*	-	-	-	4	6	5	11	7	-	8	-	2
7.*Ascaris lumbricoides*	24	38	43	48	51	56	70	64	75	49	25	28
8.*Enterobius vemicularis*	2	-	4	-	4	5	7	14	2	5	0	3
9.*Trichiuris trichiura*	10	12	18	19	21	20	27	25	22	13	9	15
10.*Necator americanus*	22	27	34	39	46	48	48	46	38	36	29	36
11.*Strongloides stercoralis*	11	15	13	15	12	14	16	13	12	9	7	8
Total	76	114	147	180	216	232	266	266	234	187	110	122
Prevalnce (%)	30.4	45.6	58.8	69.2	80.0	82.8	95.0	95.0	86.6	69.2	40.7	45.1

mm, millimetre of rainfall (form meterological Division, Benin city, Nigeria).

Table 3- Monthly prevlence of the parasitic infection in children in Benin city from Jan. 1998 to Dec. 1998

Number of children Infected Mouthly between Jan. 1998 and Dec. 1998													
Months	J	F	M	A	M	J	J	A	S	O	N	D	Total (in 2 years)
Mean rainfall (mm)	44	2	105	105	214	214	306	95	387	244	58	42	
Population Sampled (n)	250	250	250	270	270	280	280	280	280	270	270	270	6430
Parasite Species													
1. *Entamoeba histolytica*	5	9	6	14	17	21	19	18	26	28	17	13	392
2. *Entamoeba coli*	7	7	9	16	15	17	17	19	22	15	6	3	314
3. *Giardia lamblia*	7	7	14	15	17	18	17	16	25	14	17	6	339
4. *Schistosoma mansoni*	5	7	6	8	8	9	11	10	9	5	3	-	160
5. *Fasciola gigantica*	-	-	4	10	12	14	15	11	7	-	2	-	154
6. *Taenia sp.*	-	2	4	6	7	10	9	4	3	2	-	-	90
7. *Ascaris lumbricoides*	36	42	44	41	46	55	67	63	46	37	26	23	1097
8. *Enterobius vemicularis*	-	-	2	7	8	14	9	6	4	-	2	-	98
9. *Trichiuris trichiura*	14	19	22	20	27	25	29	23	16	15	11	9	441
10 *Necator americanus*	34	38	41	43	47	45	30	44	32	29	36	20	897
11. *Strongloides stercoralis*	6	7	9	11	12	14	11	10	8	6	7	8	254
Total	114	138	161	191	216	242	243	224	198	151	127	82	4236
Prevalnce (%)	45.6	55.2	64.4	70.7	80.0	86.4	86.7	80.0	70.7	55.9	47.0	30.3	65.8

mm, millimetre of rainfall (form meterological Division, Benin city, Nigeria).

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