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Investigation of Human Schistosomiasis and Other Parasitic Infections among Early School Children in Makurdi Metropolis

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Abstract

This study investigates the prevalence of human schistosomiasis and other parasitic infections among early school-aged children in the Makurdi metropolis, Benue State, Nigeria. A total of 424 stool and urine samples were examined, with 220 (52.0%) collected from children in the Wadata community and 204 (48.0%) from Northbank. The participants included 218 males (51.4%) and 206 females (48.6%). Overall, 137 children (32.3%) were infected with at least one parasite, with a higher prevalence among males (36.7%) compared to females (27.7%). Infections with *Schistosoma haematobium* and *Schistosoma mansoni* were detected in 1.8% and 0.9% of the participants, respectively. Eight different parasitic species were identified, with *Ascaris lumbricoides* (6.6%) and hookworm (6.1%) being the most prevalent in single infections. The most common dual parasitic infection was *Ascaris lumbricoides* and hookworm (4.2%), while the most observed triple infection involved *Hookworm*, *Entamoeba histolytica*, and *Ascaris lumbricoides* (1.7%). Multiple infections frequently included *Ascaris lumbricoides*, followed by hookworm. Children aged 11–15 years showed the highest infection prevalence (41.3%), although the relationship between age and infection rate was not statistically significant ($p > 0.05$). Contributing factors to infection included poor sanitation, inadequate access to basic amenities, and limited awareness about

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schistosomiasis and intestinal parasites. The study underscores the need for coordinated efforts by government and non-governmental organizations to improve living conditions and enhance public health education in affected communities.

Keywords: Human Schistosomiasis; Parasitic Infections; School-Aged Children; *Ascaris lumbricoides*; Makurdi Metropolis

Introduction

Schistosomiasis (bilharziasis as the infection was first described by the German physician Theodore Bilharz) is water borne parasitic disease caused by schistosoma, the diagnetic trematode found in the blood vessels of man and livestock [1]. The three main species infecting humans are *Schistosoma haematobium,* found in Africa and the Middle East; *Schistosoma japonicum* found in China, Southeast Asia and the Philippines, and *Schistosoma mansoni found* in Africa and South America Two other species, more localized geographically, are *Schistosoma mekongi* and *Schistosoma intercalatum* [2]. The two other species are *Schistosoma intercalatum*, found in Central and West Africa and. *Schistosoma mekongi*, found in parts of Southeast Asia [3].

The disease is considered to be a major health problem and remains one of the most prevalent parasitic infections in most tropical and subtropical countries. According to World Health Organization, more than 200 million people are affected with this disease across Africa, Middle East, China and South Asia.

Among human parasitic diseases, Schistosomiasis is the second socio-economically devastating disease after malaria in tropical and subtropical areas. The disease affects many people in developing countries particularly children who may acquire it by swimming or playing in infected water.

There are two major forms of Schistosomiasis found in Subsaharan Africa namely; *Schistosoma haematobium* and *Schistosoma mansoni* thou about 60-70% of the Schistosomiasis cases are as a result of *Schistosoma haematobium* infection [4]. The disease is transmitted by snails of different species. *Schistosoma haematobium* is transmitted by snail belonging to genus bulinus while *S mansoni* is transmitted by those of Biomphalaria. Humans get infected with this disease by exposure to *Schistosoma haematobium* and *Schistosoma mansoni* in fresh water such as rivers, streams, lakes and swamps in endemic areas. Water associated activities such as swimming, farming, bathing, cooking and irrigating or playing in water logged areas can

serve as source of infection once the intermediate host concerned is present. According to United Nations and World Health Organization, 900 million people do not have access to an improved water source while an estimated 2.5 billion, half of all people in developing countries lack access to adequate sanitation. Schistosomiasis has been associated with factors such as extreme poverty, lack of public health facilities and unsanitary conditions.

Schistososma haematobium is associated with urinary Schistosomiasis while *Schistosoma mansoni* cause intestinal Schistosomiasis. Symptoms associated with *Schistosoma haematobium* range from abdominal pains to squamous cells carcinoma of urinary bladder, urolithiasis, urinary tract infections, renal failure, eosinophilia, flaccid paraplegia, calcification of the bladder wall and a host of others. While those associated with *S mansoni* include abdominal pains, glanulomatous disease in spinal cord, colonic polyposis with blood diarrhae, portal and pulmonary hypertension and a host of others.

Helminth infections with Soil-Transmitted Helminths, *Schistosoma mansoni* and *Schistosoma haematobium* are rarely fatal, but cause long-term chronic morbidity. This may include anaemia due to blood loss from intestinal or urinary tract bleeding, iron-deficiency linked to nutritional impairment such as malabsorption and other digestive disorders like diarrhoea. Nutritional impairment and competition for nutrients with intestinal parasites further affect the nutritional status leading to malnutrition and impaired child growth [4].

Schistosomiasis, one of the most prevalent neglected tropical diseases, is a life-threatening public health problem in rural communities. Increased urination and defecation by infected persons into freshwater bodies containing the intermediate snail hosts in which the parasite under goes asexual development is a significant risk factor [3].

Morbidity due to soil transmitted helminthes infection is related to the number of worms harboured. People with light infections usually have no symptoms. Heavier infections can cause a range of symptoms including intestinal manifestations (diarrhoea and abdominal pain), general malaise and weakness, and impaired cognitive and physical development. The nutritional impairment caused by soil-transmitted helminths is recognized to have a significant impact on growth and physical development. Hookworms cause chronic intestinal blood loss that can result in anaemia Individuals living primarily in rural areas of low-income countries commonly harbor multiple parasitic infections, including infection with multiple helminth species [5]. In particular, Urinary Schistosomiasis, intestinal schistosomiasis and polyparasitic soil-transmitted helminths

(STHs) infections constitute major public health problems in sub-Saharan Africa [6-7]. Globally, 207 million and 2 billion people are infected with schistosomiasis (SCH) and soil transmitted helminths (STH) respectively where most of the affected people are primary school age children (Midzi, 2010).

In Nigeria, Benue state and particularly in Makurdi where the general standard of living is low coupled with poor sanitation and no good means of water supply, most people cannot afford or have access to good source of water supply thus making use of streams or other sources for bathing, washing and cooking increases risk of infections. Also, the occurrence of periodic flooding in most parts of Makurdi constitutes to sources of parasites especially intestinal forms among pre-school and school aged children as the environment suffers chemicals and other hazardous substances which eventually contaminate the water body. Considering the fact that infection is most likely higher in children who are constantly involved in water activities, the data generated from this study will increase health education among children, parents to improve public health. To this end, this study aims to investigate human schistosiasis and other parasitic infections among early school children in Makurdi metropolis.

Experimental Procedure

A pre-test questionnaire was designed in English and was used to gather information 's from the children as related to the risk factors of parasitic infections such as the demographic, socioeconomic and environmental information, personal hygiene practices, demographic factors (age, gender, and household size), socioeconomic factors (parents 'educational and employment status, source of drinking water, presence of toilet in the house, and presence of infected family member), and personal hygiene practices (washing hands before eating and after defecation, washing fruits before consumption, wearing shoes when outside, eating soil (geophagy), boiling drinking water, cutting nails periodically, and indiscriminate defecation (open defecation) and history of receiving anthelmintic treatment and health status of the participants within Makurdi metropolis.

Collection of Stool/faecal

Samples were collected from pre-school and school aged children found in Schools as well as well as those found out of school in selected villages within the communities upon acceptance from the relevant authorities and subjects. Volunteered subjects were

given two clearly labelled, wide mouth and screw-caps containers with adequate instructions on how to collect the samples. The samples were retrieved the following morning as early as it was possible and were transported immediately to the laboratory in Federal University of Agriculture, Makurdi Health Centre, Benue State.

Urine Sedimentation technique

After thorough shaking of the collected urine sample, contents were emptied into a test tube and placed into a centrifuge machine and centrifuge for 2 minutes at 2000RPM. The supernatants layer formed was poured out leaving behind the deposits which were further placed on a microscopic slide and viewed at x10 and then x40 objectives under the microscope.

Direct wet mount for stool

A drop of normal saline was placed on a clean microscopic slide and an applicator stick was used to pick a small drop of the feacal sample from the portion most suspected to carry the parasites (portions containing blood or mucus) and placed on the drop of the normal saline on the microscopic slide. He sample was properly mixed with the drop of saline to emulsify. Mixture was covered with a cover slip and placed under the microscope and then examined at x10 and then x40 objectives.

Formol ether sedimentation

About 1g of stool sample was placed in a test tube using an applicator stick. 10 ml of 10% formalin was added to the feacal sample in the test tube and mixed thoroughly until a clear suspension was obtained. The mixture was passed through a guaze filter fitted in a funnel, into a centrifuge test tube. The filter was removed and discarded with the lumpy residue. 3ml of ether was added to the mixture and mixed properly for one minute after which the sample was transferred back into the centrifuge and centrifuged for one minute at 2000 RPM. Two layers were formed after centrifugation, the supernatant and the sediment. The supernatant layer was poured out leaving the sediment behind. The tube was kept in a test tube rack to allow the drops of the fluid by the wall to drain down to be re-suspended in the sediment and then mixed together. A drop of the sediment was further placed on a clean microscopic slide and covered with a cover slip. An iodine stained preparation was also made for identification of cyst. Samples viewed under the microscope at x10 and then x40 objectives.

Identification of parasites

All parasites were carefully identified and differentiated with the aid of a parasitology manual using their distinguishing morphological features for each parasite as described by [8]. Also, this identification was properly made and confirmed through the assistance of the laboratory scientist working in the Lab where the samples for this study were examined.

Data Analysis

Data was analyzed using descriptive analysis to express prevalence of infection in percentage and Pearson 's χ^2 test to determine the association between the dependent variable and demographic factors (age and gender), socioeconomic factors (parents 'educational and employment status, source of drinking water and presence of toilet in the house), and personal hygiene practices (washing hands before eating and after defecation, washing fruits and vegetables before consumption, wearing shoes when outside, eating soil (geophagy), boiling drinking water, cutting nails periodically, and indiscriminate defecation) as explanatory variables.

Data were entered into and processed using SPSS (version 16.0) for WINDOWS at 5% level of significant $P<0.05$) and Microsoft Excel was used to present the results in tables and figures.

Results and Discussion

A total of 424 samples were examined from Wadata and Northbank Communities in Makurdi Local Government Area of Benue State, being the study areas. 220 (52.0%) samples were collected from Wadata while the remaining 204 (48.0%) samples were collected from Northbank (Table 1). Out of the total number of sampled examined, 218 (51.4%) were from the male participants while the remaining 206 (48.6%) were from the female participants. However, a total of 137 (32.3%) participants were generally infected with at least one parasite, out of which 80 (36.7%) of male while 57 (27.7%) were females (Table 2). A total of eight (8) different parasites were seen in the study area, and they are; Hookworm, *Ascaris lumbricoides*, *Giardia lambia, Schistosoma haematobium, Schistosoma mansoni, Strongyloides stercoralis, Entamoeba histolytica and Taenia Species* (Table 3). The most commonly seen parasite is *Ascaris lumbricoides* followed by hookworm having a prevalence of 6.6% and

6.1% respectively in single infections. Parasitic combination of Ascaris and hookworm is the most commonly observed double parasitic infection with a prevalence of 4.2% while in triple infection, the combination of Hookworm, *Entamoeba histolytica* and *Ascaris lumbricoides* is the most seen with prevalence of 1.7%. However, in all multiple infections, *Ascaris lumbricoides* is the most observed followed by Hookworm.

Table 1 shows that participant in Wadata recorded the highest prevalence of single infection (20.1%) and tripple infection (5.0%) while double infection is higher among participants in Northbank with a prevalence of 11.8%. There is no statistically significant difference that exists between Wadata and Northbank with respect to infection rate.

Table 1: Percentage prevalence of parasitic infection with respect to Location

Location	No.Examined	Single No(%)	Double No(%)	Triple No(%)	Total No(%)
Wadata	220	45(20.1)	20(9.1)	11(5.0)	76(34.5)
Northbank	204	33(16.2)	24(11.8)	4(2.0)	61(30.0)
Total	424	78(18.4)	44(10.4)	15(3.5)	137(32.3)
X^2=2.000	df=1	P>0.05			

There is no statistically significant difference in the infection rate between the male and the Female respondents as shown in Table 2. The male participants are more parasitized than the female with the prevalence of 19.7%, 12.4% and 4.6% for single, double and triple infection respectively.

Table 2: Percentage prevalence of parasitic infection with respect to sex of participants

Gende	No. Examined	Single No(%)	Double No(%)	Triple No(%)	Total No(%)
Male	218	43(19.7)	27(12.4)	10(4.6)	80(36.7)
Female	206	35(17.0)	17(8.3)	5(2.4)	57(27.7)
Total (%)	424(100)	78(18.4)	44(10.4)	15(3.5)	137(32.3)
X^2=2.00	df=1	P>0.05			

Table 3 showed that *Ascaris lumbricoides* is the mostly commonly found parasite in both single and multiple parasitic infection followed by Hookworm. *Ascaris lumbricoides* had a prevalence of 6.6% single infection and appear to be the most occurring parasites in multiple infections followed by hookworm. In all, participants had the highest prevalence of 4.2% prevalence of double infection with hookworm and *Ascaris lumbricoides*. And this

double infection is m,ost prevalent among the participants in Wadata (2.4%). However, there is a higher prevalence of 4.7% *Ascaris lumbrioides* infecton among the participants in Wadata whereas participants in Northbank recorded a higher prevalence of 3.3% prevalence of Hookworm infection among its participants. Only 0.9% prevalence with *S.haematobium* among the participants was recorded and are mostly seen in Wadata.

Table 3: Percentage prevalence of parasitic infection with respect to communities of participants

Parasites	Location		
	Wadata No(%)	Northbank No(%)	Total No(%)
S.h	4(0.9)	3(0.7)	7(1.7)
S.m	1(0.2)	1(0.2)	2(0.5)
A.l	20(4.7)	8(1.9)	28(6.6)
H.w	12(2.8)	14(3.3)	26(6.1)
G.l.	1(0.2)	1(0.2)	2(0.5)
E.h	4(0.9)	6(1.4)	10(2.4)
T.spp	2(0.5)	0(0.0)	2(0.5)
S,st	1(0.2)	0(0.0)	1(0.2)
Sh.Sm	1(0.2)	0(0.0)	1(0.2)
A.l+S.m	0(0.0)	1(0.2)	1(0.2)
Hw+S.h	2(0.2)	3(0.7)	4(0.9)
A.l+Hw	10(2.4)	8(1.4)	18(4.2)
Eh+A.l	3(0.7)	6(1.4)	9(2.1)
H.w+T.spp	1(0.2)	0(0.0)	1(0.2)
Hw+G.l	1(0.2)	1(0.2)	1(0.5)
Al+T.spp	1(0.2)	0(0.0)	1(0.2)
H.w+E.h	2(0.5)	5(1.2)	7(1.7)
E.h+A.l+S.h	3(0.7)	0(0.0)	3(0.7)
H.w+E.h+A.l	5(1.2)	2(0.5)	7(1.7)
T.t+A.l+H.w	0(0.0)	1(0.2)	1(0.2)
G.l+A.l+H.w	1(0.2)	1(0.2)	1(0.2)
T.t+A.l+S.h	1(0.2)	0(0.0)	1(0.2)
H.w+S.st+A.l	1(0.2)	0(0.0)	1(0.2)
Total	**76(33.9)**	**61(30.0)**	**137(32.3)**

X^2=207.000 df=198 p>0.05

As depicted in Table 4, open defecation is the most observable habit among all in the study area with a prevalence of 29.2% always practicing it, yet had no significant impact on parasitic infection. In addition to this, boiling of water before drinking, geophagy and keeping of ling nails did not statistically influence parasitic infection. However, the rest of the epidemiological factors statistically influenced parasitic infection at 5% level of significance.

Table 4: Attitude of respondents and its epidemiological relationship with the general status of parasitic infections among the participants

Epidemiological Factors		Total	Infection Status positive (%)	Negative(%)	X^2	df	Significant level (e=0.05)
Open Defecation	Always	104	40(29.2)	64(22.3)	1.426	2	P>0.05
	Sometimes	280	68(49.6)	212(73.9)			
	Never	40	29(21.2)	11(3.8)			
Washing of hands After visiting the toilet	Always	90	26(19.0)	64(22.3)	12.149	2	P<0.05
	Sometimes	282	92(67.2)	190(66.2)			
	Never	52	19(13.9)	33(11.5)			
Washing of hands before eating	Always	180	40(29.2)	140(48.8)	4.835	2	P<0.05
	Sometimes	242	9670.1)1	46(50.9)			
	Never	2	1(0.7)	1(0.3)			
Washing of fruts before eating	Always	102	26(19.0)	76(26.5)	4.237	2	P<0.05
	Sometimes	274	89(65.0)	185(64.5)			
	Never	48	22(16.1)	26(9.1)			
Walking barefooted	Always	44	21(15.3)	23(8.0)	5.123	2	P<0.05
	Sometimes	362	114(83.2)	248(86.4)			
	Never	18	2(1.5)	16(5.6)			
Boiling of Water before Drinking	Always	15	3(2.2)	12(4.2)	2.277	2	P>0.005
	Sometimes	84	28(20.4)	56(19.5)			
	Never	325	116(84.7)	209(72.8)			
Goephagy	Always	4	1(0.7)	3(1.0)	1.111	2	P>0.05
	Sometimes	160	48(35.0)	112(39.0)			
	Never	280	88(64.2)	192(66.9)			
Keeping Long finger Nails	Always	20	7(5.1)	13(4.5)	2.288	2	p>0.05
	Sometimes	274	92(67.2)	182(63.4)			
	Never	130	38(27.7)	92(32.1)			

Highest level of knowledge by respondents as showed in the Figure 1 is displayed towards the knowledge about intestinal parasites signs and symptoms with a prevalence of 34.9% of respondents. However, respondents showed the least knowledge towards Schistosomiasis with a prevalence of 19.8%.

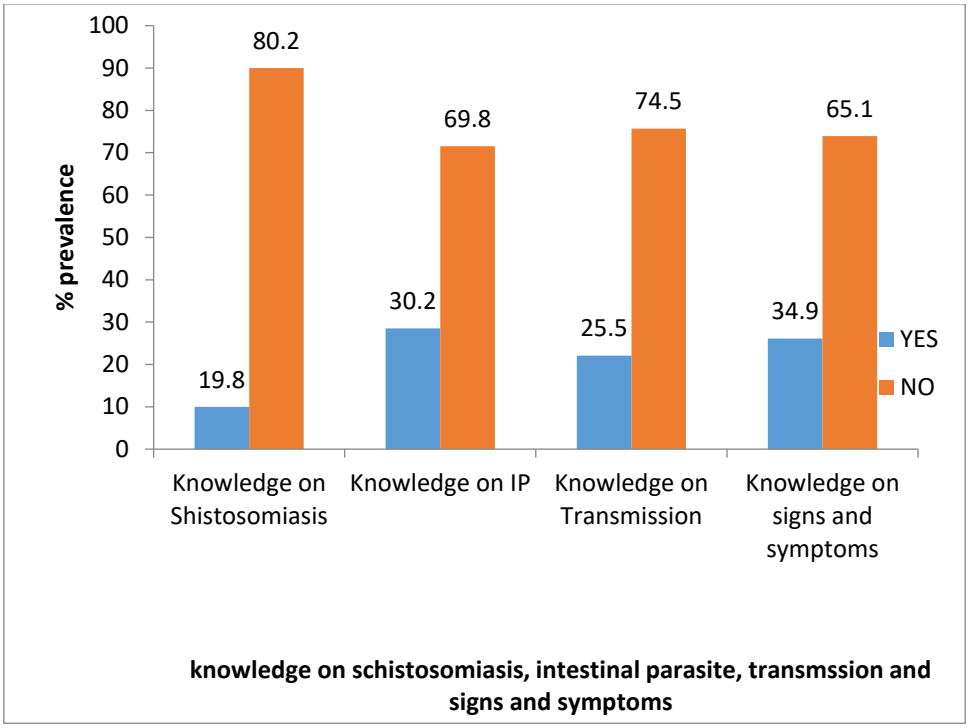


Figure 1: Respondents level of knowledge on parasitic infections

Figure 2 shows that a very significant number of the study population has no single perception on the causes of schistosomiasis. This is not surprising hence they have very little or no knowledge on what schistosomiasis is. However, for those who are opportune to have at least little knowledge on schistosomiasis, 5.0% of these respondents (being the highest) have attributed the causes of schistosomiasis to poor hygiene practices, while 3.0% of these respondents attributed the causes of schistosomiasis to the lack of toilet facilities.

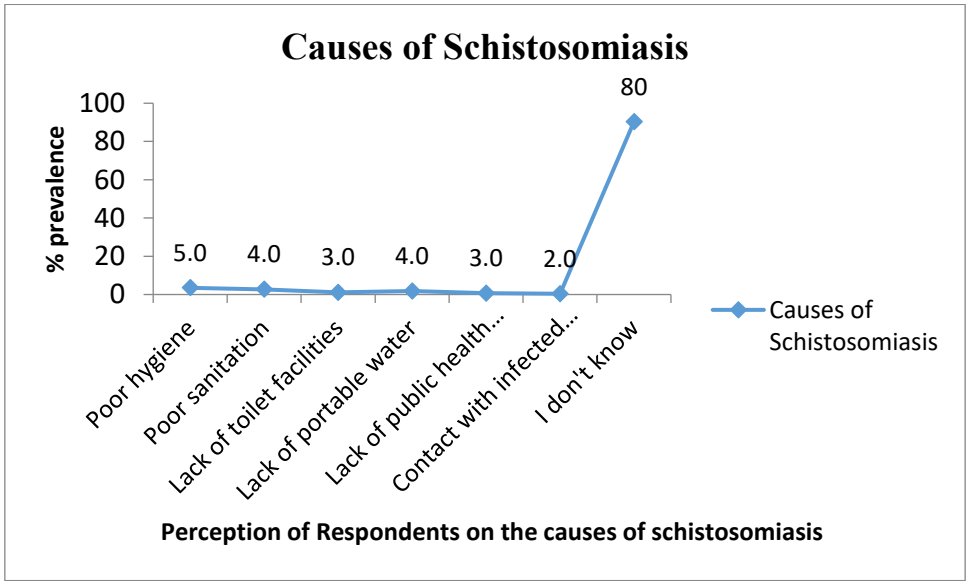


Figure 2: Perception of respondents on Schoistosomiasis

Findings from this study has showed a relatively lower infection rate with a total prevalence of 32.3% (Table 1) compared to the findings of Al-Delaimy *et al.*, 2014 which records 98% prevalence of at least one parasite species. The study of [9] has also showed a little higher prevalence of 53.5% of parasitic infection compared to what was observed in this study.

Double infection with the prevalence of 10.4% and triple infection with the prevalence of 3.5% as observed in this study were low compared to the findings of [10] which showed 54.3% and 17.7% double and triple infection respectively. Findings from this study also showed similarity with the findings of [11] who had recorded 9.1% prevalence of double infection and 0.7% prevalence of triple infections in his study. Though, the prevalence of triple infection recorded in [11] is slightly lower than what was observed in this study.

The most common double infection as seen in this study consist of Hookworm and Ascaris lumbricoides and is in total agreement with the findings of [12-13] but disagrees with the findings of [10] whose findings showed that the most common double infection is that of *Ascaris lumbricoides* and *S.haematobium*. Also in this study, the most common triple infections as showed in Table 3 were Hookworm, *Ascaris lumbricoides* and *Entamoeba histolytica* which has a slight deviation from the findings of [10] where *Ascaris lumbricoides*, Hookworm and *S. haematobium* were the most common triple infection. No individuals had up to four parasites which is very similarly to so many other findings like that of [11,13].

The highest prevalence of *Ascaris lumbricoides* (6.6%) in a single infection is followed by Hookworm (6.1%) in table 4.6 is similar to the study of [10] who recording 39.6% prevalence of *Ascaris lumbricoides* as the most common parasite followed by Hookworm with the prevalence of (18.3%). This finding is also in concordance with that of [14] who recorded 6.2% prevalence of *Ascaris lumbricoides*, and the findings of [15] who recorded 19.1% as the most prevalent parasite infecting school aged children.

Conclusion

The study has revealed that the most predominant parasitic infection comprises of *Ascaris lumbricoides* and Hookworm at all level of infection. It is evident that the males are more generally exposed to parasitic infection than their female counterparts hence they are

more infected. School aged children especially those within the age group of 11-15 years have proven to be more vulnerable to parasitic infection probably due to their much exposure to the seeded-egg on play grounds. Moreover, it is without doubt that poor sanitation, social and economic conditions and other basic social amenities constitutes significant epidemiological factor in the spread of parasitic diseases. Inadequate knowledge on the causes, mode of transmission as well as their signs and symptoms is another important epidemiological factor to identify with in this study. Based on these findings, this study recommends that aggressive health education should be reinstated into the school curriculum. For those who are not yet opportune to be in school, door to door health education is needed especially in the rural areas.

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