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PREVALENCE OF SOIL-TRANSMITTED HELMINTHS AMONG PRIMARY SCHOOL CHILDREN IN YANA, BAUCHI STATE, NIGERIA

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ABSTRACT

Soil-Transmitted Helminths (STH) infections in developing countries like Nigeria still pose serious public health problems. The present study, therefore aimed to assess the prevalence of STH infections among students at Yana, Shira Local Government Area, Bauchi State Nigeria, from two randomly selected primary schools. A total of one hundred thirty-two students participated in the study. Stool samples were collected using clean sample bottles and processed by a standard parasitological technique for microscopic detection of STH. Data were analyzed using Chi square in SPSS version 24. Among the 132 (87 male and 45 female) children participated, 57 (43.2%) and 75(56.8%) were within the age groups of 4–6 and 7–10 respectively among the two schools. Fifty (37.9%) of them were tested positive for STH parasites. Hookworm (24, 18.1%) was the most frequently detected STH parasite followed by *A. lumbricoides* (14, 10.6%), *Trichuris trichiura* (9, 6.8%) and *Taenia* spp (3, 2.3%). There was no significant difference ($p > 0.05$) in prevalence of different STHs infections in relation to age group and gender across schools. This study also identified ova and larvae of STHs parasites in the analyzed soil samples from the studied schools. The prevalence of STH parasitic infection among school age children in this study area is still unacceptably high. This must relate to poor hygienic condition in the study area such as poor water supply, poor hand washing material as well as poor sanitary conditions. Therefore, school-based deworming and school health programs should be integrated to reduce the prevalence of STHs infection among the school-age children in the study area.

Keywords: Shira, Nigeria, School Age Children, Soil-Transmitted Helminths (STH) Infections, Prevalence

INTRODUCTION

Soil-transmitted helminths (STH) are among the most prevalent of human parasitic infections affecting more than a quarter of the world population (approximately 2 billion people) thereby causing a significant morbidity and mortality (Tulu *et al.,* 2014, Jourdan *et al.,* 2018, Casavechia *et al.,* 2016). Out of the total number of people affected, 400 million become ill in which majority are being children from developing countries more especially in the sub-Saharan African countries. The high infestation rate of STH in those regions is closely related with absent of clean water supply, impoverished health care and education, poor

environmental sanitation, poor housing and chronic poverty (Ekundayo *et al.,* 2007). In addition to school children that account for most of the STH infections, large numbers of pregnant women are also affected, and this is responsible for a significant number of mortalities among them (Vercruysse *et al.,* 2011). However, regardless of the on-going intervention to control this infection such as periodic mass deworming of pupils in Nigeria and other developing countries, finding from other studies shows that prevalence of STH infection is still high among school children (Abe *et al.,* 2019, Ahmed and Sani, 2019, Eyamo *et al.,* 2019, Chinyem et al., 2017).

In spite of the fact that a several studies have shown that there is high prevalence of STH among school children in various part of Nigeria but to the best of our knowledge, there have been no other published studies on the status of STH infections among school-age children in the Yana, Shira Local Government Area, Bauchi State Nigeria. Therefore, the present study aimed at providing information on the current status of prevalence of STH among preschool and school-aged children primary schools in Yana. It is hoped that this will help provide useful information about the level of STH infection and in the study area and how to control their parasitic infections.

MATERIALS AND METHODS

Study Area and Period

This study was conducted in Yana, Shira Local Government Area, Bauchi State. Bauchi State is located in the North East region of Nigeria. The state has 20 Local governments with land mass of 49,259 km (Chinyem *et al.,* 2017). The people of Yana, Shira are predominantly civil servants and farmers. The present work was a cross-sectional study conducted from June to November 2019 to determine the level of STH infection among school-age children in Yana.

Ethical approval

Ethical approval was obtained from the headmasters of the 2 schools in Yana, Shira Local Government Area of Bauchi State selected for this study. Verbal consent was also obtained from them.

Selection of Schools

This study was conducted in two randomly selected public schools in Yana, Bauchi state namely Yana Nursery and Primary School and Reliable Academy School, Yana which include public and private school, respectively.

Sample Collection

Collection of faecal Samples for Presence of STH

Well labelled sterile plastic containers were provided to the randomly selected student from the selected schools. The pupils were all asked to take their early morning faecal in the provided container for the analysis. One stool sample was collected from each pupil. Information such as name, sex and age were obtained from each pupil that participated in the study. For each school, the pupils were divided into two groups according to their ages (4-6 years and 7-10 years). A total of 132 faecal samples collected were taken to the Laboratory of Department of Biological Sciences, Bauchi State University Gadau, for analysis and examination. All stool samples collected

were analyzed using rapid sedimentation method and floatation method with saturated salt solution (NaCl) (Cabada *et al.,* 2015; Edosomwan *et al.,* 2019). The eggs were identified based on morphological details as described by Chiodini *et al.,* (2001).

Collection of soil samples in selected location around the selected school Environment

Soil samples were collected at three different locations within each school and each site were labelled as I, II and III which represent toilet area, playground area and classroom area, respectively. 20 grams of soil samples from each site was randomly collected. all soil samples collected were processed using floatation method with saturated salt solution (NaCl) as described by Edosomwan *et al.,* (2019) to examined the presence of helminth eggs/ova and worm at the Laboratory of Department of Biological Sciences, Bauchi State University Gadau.

Data Analysis

Data was analyzed using Chi Square in SPSS version 24 to establish significant difference in the prevalence of STH in faecal samples in the two schools in Yana, in Shira LGA of Bauchi State. A p-value of <0.05 was used as a statistically significance difference.

RESULTS

The finding from the present study revealed that there is high prevalence of STH parasites among the primary school children in Yana, Shira LGA of Bauchi State. Out of the 132 faecal analyzed, 50 (37.9%) were positive for STHs infection while those unaffected were 82 (62.1%). Thus, the pool proportion of unaffected pupils to those infected varied significantly ($\chi2 = 7.758$, df = 1, p = 0.005).

The prevalence of STH infection was further analyzed according to sex and age (Table 1). Out of the of 132 school children comprising of 87 males and 45 females attending the two primary schools, the STH prevalence was highest in males with 40.2% while females had 33.3%. In terms of age, the STHs prevalence was highest among the 7–10 years age group with 38.7% prevalence while the 4–6 age group had 36.8% prevalence. However, the prevalence of infection among primary school children with respect to sex and age showed no significant difference (sex: $\chi2 = 1.052$, df = 1, p = 0.305; age: $\chi2 = 0.76$, df = 1, p = 0.783).

Table 1: Prevalence of STHs Infection by Age Group and Sex of School Children in the Two Selected Primary School

Category	Group	Yana Nursery and Primary School, Yana			Reliable Academy school, Yana						
		No. Examined	No. Infected	%	No. Examined	No. Infected	%	Total No. Examined	Total No. Infected (%)	χ2	P-value
Age	4-6 y	30	12	40	27	9	33.3	57	21 (36.8)		
	7-10 y	40	18	45	35	11	31.4	75	29 (38.7)	0.76	0.783
Sex	Male	45	21	46.7	42	14	33.3	87	35 (40.2)		
	Female	25	9	36.0	20	6	30	45	15 (33.3)	1.052	0.305

The species of STH parasites detected include *Taenia* spp, *T. trichiura*, hook worms and *A. lumbricoides.* The results show that hookworm 24 (18.1%) was the most frequently detected species in the two schools, followed by *A. lumbricoides* 14 (10.6%), then *T. trichiura* 9 (6.8%) and *Taenia* spp which have the least prevalence rate of 3 (2.3%). Yana Nursery and Primary School was implicated with the highest number of STH infection of 30 (42.9%) than Reliable Academy School, Yana 20 (32.3%). However, the observed differences in prevalence of STH infection between the two schools was not statistically significant ($\chi2 = 2.672$, df = 1, p = 0.102) (Table 2). The prevalence of STH was further analyzed according to two schools and the results shows that there were no significant differences in the prevalence of hookworm, *A. Lumbricoides* and *T. trichiura* between the two schools. However, the result showed that the prevalence of *Taenia* spp varied significantly ($\chi2 = 87.3$, df = 1, p = 0.001).

Table 2: Prevalence of STHs Infection by Age Group and Sex of School Children in the Two Selected Primary School

	Yana Nursery and Primary School, Yana			Reliable Academy School, Yana						
Parasites	**No. Examined**	**No. Infected**	**%**	**No. Examined**	**No. Infected**	**%**	**Total No. Examined**	**Total No. Infected**	**%**	**χ2**	**P-value**
Any infection	70	30	42.9	62	20	32.3	132	50	37.9	2.672	0.102
Hookworm	70	14	20.0	62	10	16.1	132	24	18.1	1.527	0.217
A. lumbricoides	70	8	11.4	62	6	9.7	132	14	10.6	0.912	0.340
T. trichiura	70	5	7.1	62	4	6.5	132	9	6.8	0.341	0.559
Taenia spp	70	3	4.3	62	0	0	132	3	2.3	87.300	0.001

Following the analysis of soil sample from different sites of the schools, the toilet area has the highest prevalence of 80%, followed by playground and classroom area which have 10% each. However, there was significant difference ($\chi2=9.800$, df=2, p=0.007) in the prevalence STH parasites in the different sample's sites (Table 3). Hookworms, *T. trichuira* and *A. Lumbricoides* are the different types of STH parasites found in the soil samples within the two studied schools. Hookworm and *A. Lumbricoides* are the most frequent STH parasites found on the soil samples (40%) while *T. Trichuira* has the least (20%). The result from the study showed that out of the two schools, soil samples from Yana Nursery and Primary School had the highest number of the STHs parasites than Reliable Academic Yana.

Table 3: Prevalence of STH Parasites on Soil Samples of the Two Selected Schools.

Parasite species	Yana Nursery and Primary School, Yana			Reliable Academy School, Yana						
	Toilet Area	Playground Area	Class room Area	Toilet Area	Playground Area	Class room Area	Total	%	$\chi 2$	P-value
Hookworm	2	1	0	1	0	0	4	40		
A. lumbricoides	1	0	1	2	0	0	4	40	9.800	0.007
T. trichiura	1	0	0	1	0	0	2	20		

DISCUSSION

The present study investigated the prevalence of STH infection in two primary schools in Yana, Shira LGA of Bauchi State, Nigeria. The findings from this study revealed that, the overall prevalence of the STH infection was 37.9% in the study area. The burden of STH parasites observed in the present study may pose a serious threat to the students of these schools as it is higher than the prevalence threshold set by World Health Organization (WHO) for mass treatment of endemic communities. This result goes in line with the finding of Abe *et al.*, (2019) in Nasarawa, Nigeria which recorded 33.5% overall prevalence of STH infection among school children. The finding from the present study is also in agreement with that of Omotola and Ofoezie (2019) and Ahmed and Sani (2019) that recorded high STH burden among school children in Osun and Katsina State, Nigeria respectively. Similar reports were also reported in other parts of the world such as Ethiopia (Hailegebriel, 2017), South Africa (Nxasana *et al.*, 2015), Ghana (Forson *et al.*, 2018) and Sudan (Suliman *et al.*, 2019).

STH infections always remain a global problem more especially among school children as it is estimated that 400 million of them are affected (Gyang *et al.*, 2017). The high prevalence of STH among school children may be due to continuous exposure to risk factors of infection which may include poor hygienic habits, poverty, lack of basic knowledge about the transmission of infection, insufficient water supply, indiscriminate defecation and lack environmental sanitation. All these aforementioned factors constitute a major health concern and might affect the wellbeing of most people living in the study area. The STH parasites found in the present studies are *A. Lumbricoides*, hookworms, *Taenia* spp. and *T. trichiura*, with hookworm being the most observed parasites.

The high prevalence of hookworm in the present study could be attributed since most of the children play barefooted and this might have exposed them to hookworm larvae infective stage. Moving bare footed or not wearing of protective shoes is common among school children in public school in the developing countries. So also, the use of human waste-contaminated water and human excreta as manure might also be responsible for hookworm infection in the study area since children and their parents often go to the farm to tender the vegetables (Tyoalumun *et al.*, 2016). In addition, the warmth, moisture, shade and optimum temperature of 23^{o}C to 30^{o}C which are suitable environmental condition for the survival of hookworm eggs as describe by

Ukoli (1984) is also like the climatic condition of the study area. These factors might also attribute to the possibility of having prevalence of hookworm eggs and larvae in the study area.

The high prevalence recorded in this study for hookworm collaborated with previous studies done by Opara *et al.,* (2012) in AkwaIbom, Nigeria; Obiukwu *et al.* (2008) in Anambra, Nigeria; Ukpong and Agamse (2018) in Cross river which reported a 41.7%, 37.3% and 31.1%, respectively. This was higher than what was observed in the present studies. Severally studies have reported hookworm infection as the most common STH infection among children in other part of the world such as Ghana (Dankwa *et al.,* 2015), Guinea (Glickman *et al.,* 1999) and Sri Lanka (Chandrasena *et al.,* 2004).

However, the present study confirmed the triad pattern of STH infections that is common in Africa community which are *A. Lumbricoides,* hookworm and *T. Trichiura* (Ekpo *et al.,* 2008, Gyang *et al.,* 2017). All the 3 species are ubiquitous and have different mode of transmission. Hookworm are usually transmitted through expose skin as they can penetrate while in terms of *A. Lumbricoides* and *T. Trichiura,* both are transmitted by faecal-oral route.

The occurrence of *A. Lumbricoides* as the second most observed STH parasites in the present study collaborate with the findings of Afia and UdoIdang (2016) and Usip and David (2013). The possible reason for high prevalence of *A. Lumbricoides* could be that the high numbers of eggs produced by the fecund female have an enormous capacity to survive even on unfavourable environmental conditions. Furthermore, the eggs produced by these parasites are coated with mucopolysaccharides which make them possible to adhere to various surface areas like vegetables; door handles (Gyang *et al.,* 2017). Finally, the eggs can withstand in the absent of oxygen and live for up to 2 years at temperature of 5-10^{o}C (Bekele and Shumbej, 2019, Edosomwan et al., 2019). Prevalence of *T. Trichiura* was the third most observed at 6.8%, similar to the findings of Gyang *et al.,* (2017) and Ekpenyong and Eyo (2008). *Taenia* Spp infection was the least in the present at 2.3%.

Although, significant statistical difference was not observed with respect to age ($\chi 2$ = 0.76, df = 1, p = 0.783), the prevalence of STH was higher among 7-10 years (38.7%) than 4-6 years (25.5%). This suggests that that pupil between the ages of 7-10 years were the most affected. This finding may be due to the fact that pupil at that age attend to their personal care and are often treated like adults without much or little concern or assistance from their parents and teachers. This finding is agreement with to the finding of Emeka (2013). Out of the total number of 225 stool samples analyzed among school children in Enugu State, Nigeria, they found that pupil from the age of 8-10 years were the most infected.

However, this is contrary to the findings of Ekpenyong and Eyo (2008). In their study, they reported that children within the age of 4-6 years are the most affected and explained this might occur as a result of less development of their immune system. It would however be expected that at the age group, the children are treated with much care by their parent in terms of personal hygiene. So also, children of this age group are restricted to outdoors activities such as going to farm which might exposed them to soil contaminated faeces.

Gender wise, the prevalence of STH is higher among males (40.2%) than females (33.3%) even though the observed differences in prevalence by sex was not statistically significant ($\chi 2 = 1.052$, df = 1, p = 0.305). This finding may be attributed due to the fact that males are more expose or participate in more outdoor activities such as playing in contaminated soil than the female. Sometime, the male is infected because they played football barefooted or without wearing protective shoes on grounds that have been littered with faeces. This agreed with the work of Omotola and Ofoezie (2019) and Abe *et al.*, (2019) in Osun, Nigeria and Nasarawa, Nigeria, respectively, who separately reported high prevalence of STH parasites among males than female.

The presence of STH parasites eggs in the entire soil samples analyzed strongly supported the fact that these parasites are the common contaminant in soil of premises of public school. This reflects poor unhygienic practices of the school pupils across the two schools with Yana Nursery and Primary School having the highest number of the STHs parasites. Out of the three sites tested among the two sample schools, the toilet area has the highest burden of STH parasites. This finding agreed to that of Ado et al, (2020) which reported significant difference in the prevalence of STH eggs in the different sample sites with toilet area having the highest (54.76%).

CONCLUSION

The STH species causing helminthic infection among children in study area includes hookworm, *A. lumbricoides, T. trichiura*, and *Taenia* Spp. The findings from the present study revealed that hookworm and *Taenia* Spp were the most prevalent and least parasites, respectively among the children in the study area. Therefore, the result showed relatively high prevalence of STH infection among the school children. There is need to advocate the people by making them understand the various risk factors that are associated with these types of infection, there mode of transmission and method of prevention so as to curtail the problems caused by these parasites. Furthermore, school-based deworming as recommended by WHO and school health programs should also be integrated with in order to get rid of the STH parasites among the school children.

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