

PREVALENCE AND INFECTION PATTERNS OF GEO-HELMINTHIASIS IN A RURAL COMMUNITY ALONG RIVER OKUMESHI, DELTA STATE, NIGERIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

*Background: Information on geo-helminth infections in Akoku community has never been reported. This cross-sectional study was conducted to assess the prevalence and pattern of geo-helminth infections among this population, and to evaluate the impact of water source and faecal disposal system on the prevalence of geo-helminth infection. Methods: Stool samples from 300 children aged between 0 and 15 year were screened for the presence of geo-helminth infections using direct smear method and kato-katz techniques. Results: 240(80.0%) children were infected and a triad pattern of *Ascaris lumbricoides* (156, 52.0 %), hookworm (48, 16.0%) and *Trichuris trichiura* (36, 12.0%) were observed. There was no sex disparity and no significant difference ($p > 0.5$) in the prevalence of geo-helminthiasis. Prevalence was highest among age group of 0-5 years, infection rate decreasing with increasing age. Multiple helminth infection was highest for *A. lumbricoides* and Hookworms combination (24, 10.0%). There was significant difference in multiple parasitic infections ($P < 0.05$). Those subjects using stream water were more infected compared to those using well and pipe bone water ($P < 0.05$) and those using nearby bushes as source of disposal of faeces were more significantly affected ($P < 0.05$). Conclusion: The high prevalence of geo-helminth infections suggests that parasitic infections are important public health problems. Thus, enhancing socioeconomic status, improving sanitation facilities, instilling health education and promoting ways of keeping personal hygiene can be good strategies to control these infections in the area.*

Keywords: Prevalence, Geo-helminths, Transmission, Children, Control strategies Nigeria, Africa.

Contribution/ Originality

This study documents for the first time the prevalence and infection patterns of geo-helminthiasis in this rural community. The findings showed that parasitic infections are public health problems among this population and that *A. lumbricoides*, hookworm and *T. trichiura* are the common helminths that cause parasitic infection in the study area.

1. INTRODUCTION

Intestinal helminth infections represent a huge health problem in developing countries. These infections have been associated with low standard of sanitation, poverty etc. Each year, approximately 480-500 million children are infected and mortality ranges from 40,000 to 130,000 persons per year [1, 2]. Besides causing morbidity and mortality, infections with intestinal parasites are known to cause iron deficiency anemia, growth retardation in children and other physical and mental health problems [3]. Though helminthes infections can infect all members of a population, it is evident that specific groups are at greater risk of morbidity as well being more vulnerable to the harmful effects of chronic infections than others. Furthermore, studies have shown a clear trend in age predisposition to infection and reinfection with intestinal helminthiasis [4]. There are several reports from various parts of Nigeria on human intestinal helminth, including those of Adeyeba and Akinlabi [5], Ogbe, et al. [6], Nmor, et al. [2]. However, sufficient attention has not been given to Akoku community; a remote, rural community where health and environmental infrastructure are poor, inadequate or altogether lacking. Given that the both risk factor and epidemiology of helminths infestation may vary from one community to another, this study aim to evaluate the prevalence and patterns of intestinal helminths infection among children in Akoku community. The findings from this cross-sectional study would provide baseline information on the pattern of helminthiasis among this vulnerable group of children. It will also encourage appropriate health authorities to embark on interventional health programmes against helminthiasis in Nigeria.

2. METHODS

2.1. The Study Area and Subjects

Akoku is a tropical rural community in Ukwuani Local government area of Delta State Southern Nigeria. It is within the tropical rainforest belt in Nigeria. The area has a relatively high temperature ranging from 24 °C to 28 °C in the wet season but rises a little to between 28 °C to 31 °C during the dry season. The community is characterized by a plain landscape with a gentle hill between the river and the center of the community. It experiences heavy flooding during the rainy season resulting in gully erosion in some areas. The major drainage system is the Okumeshi River. The inhabitants are mainly farmers, and petty traders. The sources of water supply in the community are pond water, wells, stream, pipe borne (tap water), which runs occasionally and borehole water. Latrine facilities include water closets, pit latrines, while others defecate in the nearby bush or sometimes in well dug out open trenches. Occasionally flooding occurs during the rainy season thus increasing sanitation problems resulting from inadequate sewage and refuse disposal facilities.

Of the 329 children considered for the study, 29 children either did not return their stool sample or sample were not properly collected. Thus only 300 children who returned properly collected stool sample were included in this study. The children were of varied ages between 0 and 15 years.

2.2. Collection and Examination of Samples

Prior to sample collection, verbal consent was obtained from head of each household. Specimen containers were distributed to those who consented. A trained local field worker assisted with the distribution and collection of stool samples as well as educating the subjects on method of collection of the stool. The stool samples were collected in the morning and examined in the afternoon by direct smear method and Kato-Katz method to quantify the number of eggs per gram of faeces [7]. The examination of stool samples was carried out in the research laboratory of the Department of Animal and Environmental Biology (formally Zoology), Delta State University Abraka. To ensure consistency of the readings, second readings were performed in 20% of the slides randomly selected following the approach of Andrade, et al. [8]. All statistical analyses were performed using graphpad prism statistical software.

3. RESULTS

A total of 329 children participated in the study. However, 29 were excluded because of inability to provide stool specimen or their stool specimen was contaminated with soil (suggesting they scooped their stool sample after defaecating on bare soil). Thus a total of 300 children were included in the analysis. Of the 300 children examined, 240 children were positive for at least one intestinal helminth infections, thus putting the overall prevalence at 80.0%. Three forms of geo-helminth parasites were found in all the stool samples examined. A total of (156, 52.0%) were infected with *A. lumbricoides*, (48, 16%) were infected with hookworms while (36, 12%) were infected with with *T. trichuria* (Figure 1). Figure 2 shows that multiple helminth infections was highest for *A. lumbricoides* and Hookworms combination (24, 10.0%), while (10, 4.2%) were infected with *A. lurnbricoides*, *T. trichiura* and Hookworms and (6, 2.5%) were infected with *A. lumbricoides* and *T. trichiura*. There was significant difference in multiple parasitic infections ($P < 0.05$). The rate of helminth infections in relation to source of water use is shown in figure 3. Children who reported using pipe borne as their major source of water had significantly lower prevalence compared to those using wells and stream as their source of water (Figure 3).

Figure-1. Parasite specific prevalence of helminthiasis in Akoku community.

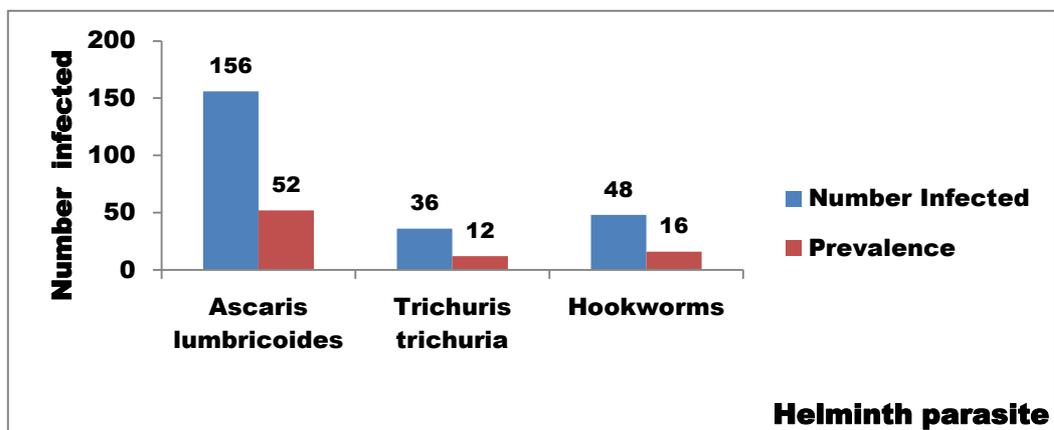


Figure-2. Mixed infections of helminthiasis among children in Akoku community.

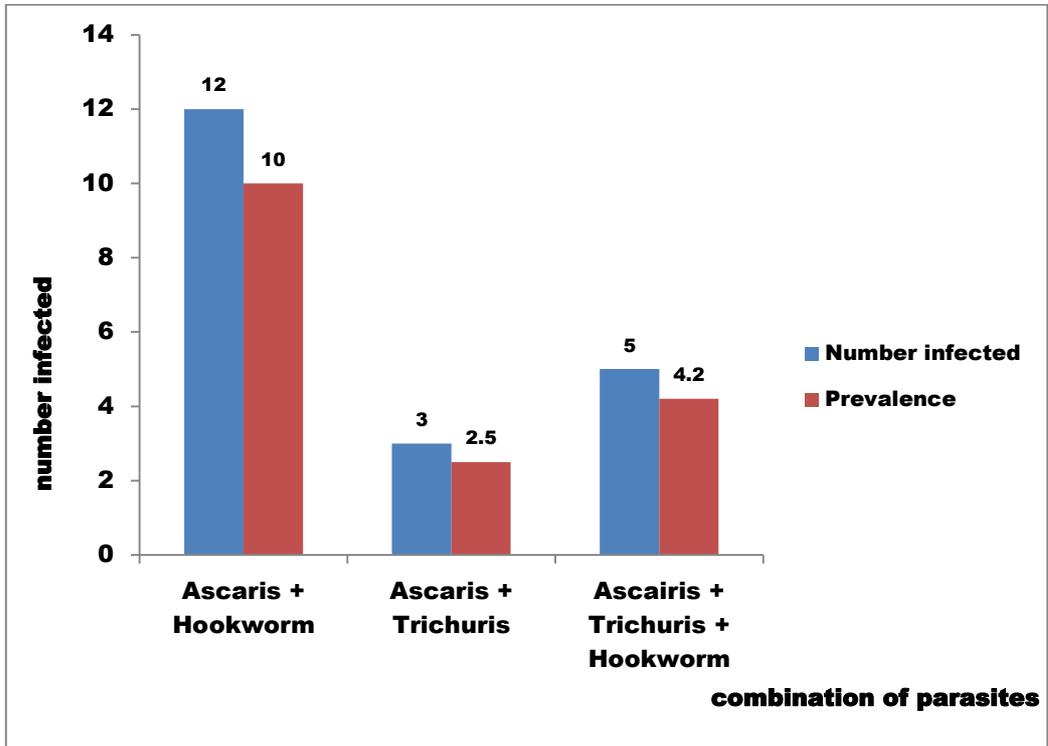


Figure-3. Water source-specific prevalence of helminthiasis among children in Akoku community

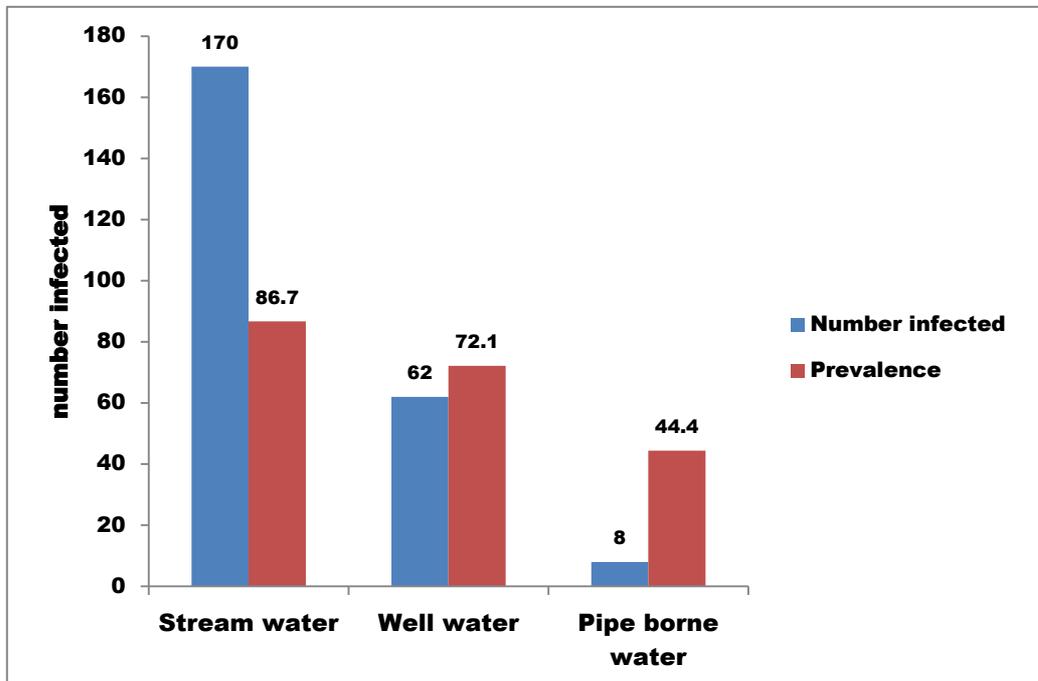


Figure-4. Prevalence of helminthiasis with respect to faecal disposal system among children in Akoku community.

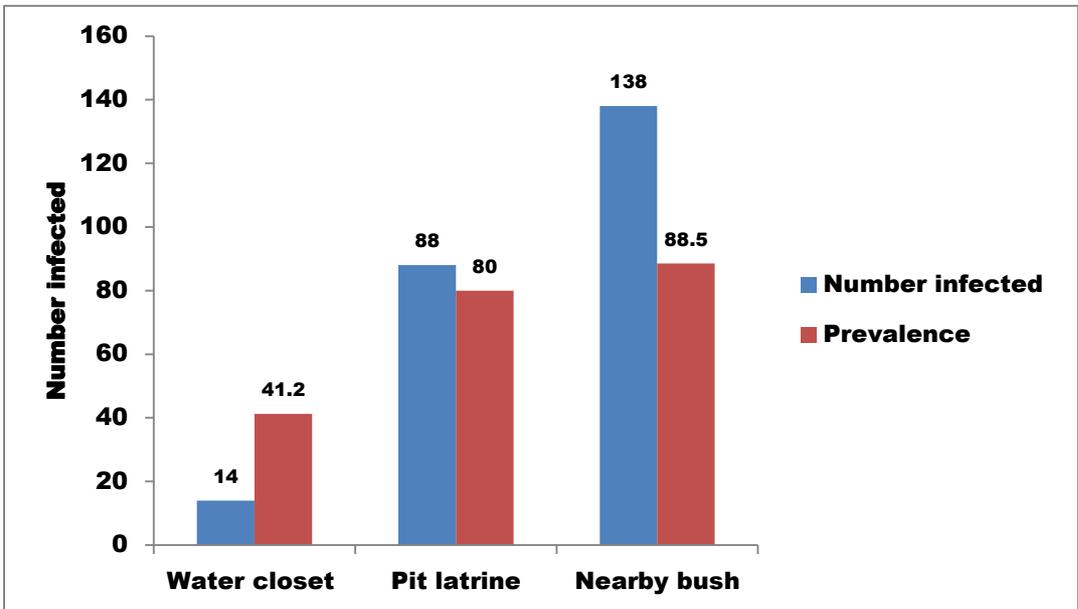


Figure-5. Intensity of parasitic infection with respect to age group among children in Akoku community.

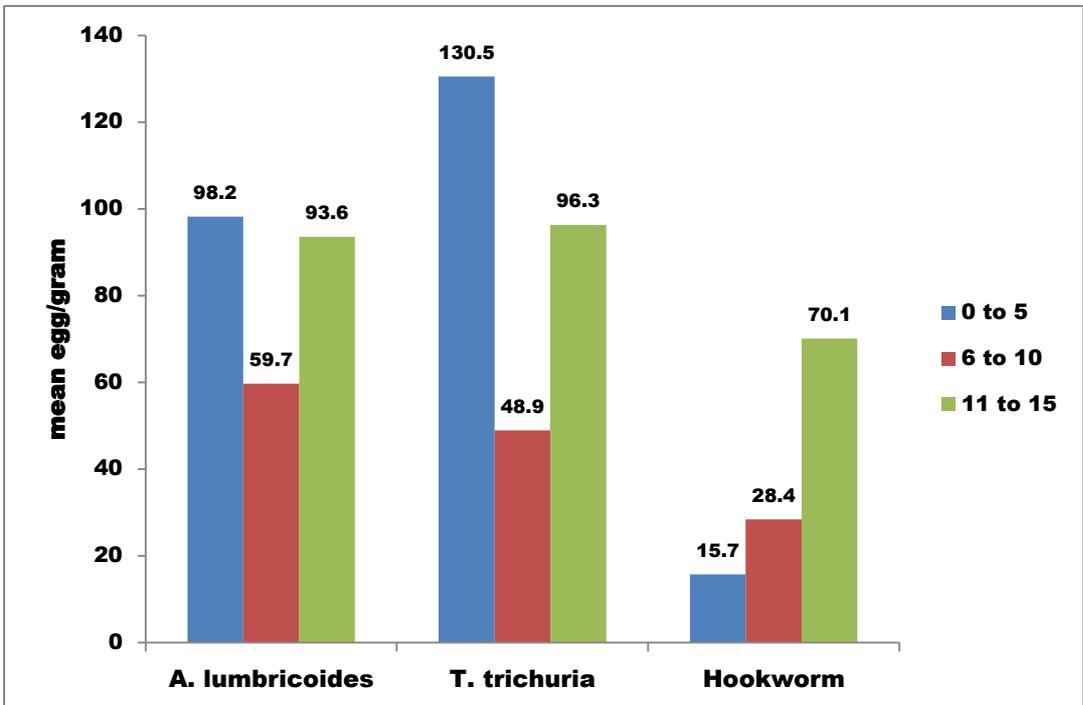


Figure 4 shows the infection rate with respect to means of faecal disposal. The prevalence of infection among those using water closet toilets was about 50% lower than those using nearby bush and pit latrine respectively. There was significant difference in the infection rate with respect to the toilet facilities used by the children ($P < 0.05$).

Data on the intensity of infection (Figure 5) shows that the children were not heavily infected. The intensity of the infection was highest among the age group of 0-5 years, infection decreasing with increasing age. Further, there was over-dispersion in the distribution of the infection.

Table 1 shows the age-sex specific prevalence of intestinal helminthes infections. Although, male children had a slightly higher prevalence for *A. lumbricoides* (86, 54.4%) compared to female children (70, 49.3%), there was no significant sex difference in the prevalence. For both sexes, the prevalence for *T. trichiura* was relatively lower compared to *A. lumbricoides* and hookworm infection. The prevalence for hookworm infection was five times higher in female (Table 1). Furthermore, the age related prevalence of helminth infections reveal that the age group 0-5 years was more infected with geo-helminthiasis, and there was a consistent decrease in the prevalence of infection with increase in age. The difference in infection rate by age group was not statistically significant ($P > 0.05$).

Table-1. Age-sex specific prevalence of intestinal helminthes infections among children in Akoku community.

	Male		Female		Overall	
	Number examined	Number Infected (%)	Number examined	Number Infected (%)	Number examined	Number Infected (%)
<i>Ascaris</i>						
0-5	36	24(66.7)	60	26(43.3)	96	50(52.1)
6-10	104	54(51.9)	60	32(53.3)	164	86(52.4)
11-15	18	8(44.4)	22	12(54.5)	40	20(50.0)
Total	158	86(54.4)	142	70(49.3)	200	156(78.0)
<i>Trichuris</i>						
	36	6(16.7)	60	10(16.7)	96	16(16.7)
	104	10(9.6)	60	4(6.7)	84	14(8.5)
	18	4(22.2)	22	2(9.1)	40	6(15.0)
Total	158	20(12.7)	142	16(11.3)	300	36(12.0)
Hookworm						
0-5	36	6(16.7)	60	10(16.7)	96	16(16.7)
6-10	104	12(11.5)	60	18(30.0)	164	30(18.3)
11-15	18	2(11.1)	22	0(0.00)	40	2(5.0)
Total	158	20(12.7)	142	28(66.7)	300	48(16.0)

4. DISCUSSION

Intestinal parasites account for much of the morbidity and mortality among infants and young children. Children under 5 years of age are the most affected group in developing countries in Africa [9]. Infected children are often physically and mentally compromised by malnutrition leading to cognitive deficits, iron deficiency anemia, growth retardation, learning disabilities and

high school absenteeism [2, 3]. Studies have clearly shown that intestinal parasites are associated with sanitation, personal hygiene, environmental and household factors to mention a few [2, 10-12] and the risk of infections differ with geographic area as well as the immunity level of the host. This factors combined may influence rate of infection [12].

The high prevalence of geo-helminth infection observed in this study reveals that helminth parasitic infection is a serious public health problem in the study area. The overall prevalence of 80.0% with one or more helminth parasites found in this study, though insignificantly lower, but is comparable with previous studies from similar ecological settings. Similar studies in Ikwano local government area, Abia State reported a prevalence of 82.6% among school children [13]. Furthermore, Nmor, et al. [2] reported a prevalence of 92.4% in their study on school children in Igbde community, Delta State. Poor sanitation and lack of adequate personal hygiene, agricultural practices and poverty may explain the high prevalence observed in this study.

In terms of specific parasite prevalence, this study observed a triad of *Ascaris*-Hookworm-*Trichuris* infections with *A. lumbricoides* having the highest prevalence (52.0%), followed by hookworm (16.0%) and *T. trichiura* (12.0%). This is not unexpected as several epidemiological studies have shown a high prevalence of *A. lumbricoides* *T. trichiura* and Hookworms infections in communities and schools [2, 5, 14]. For example, Etim, et al. [15] reported a high prevalence of *A. lumbricoides*, Hookworms and *T. trichiura* among children age between 5 - 13 years in a small community in Anantigha area of Calabar, Cross River State, Nigeria. He reported infection rate of 53.2% for *A. lumbricoides*, 31.0% for Hookworms and 27.0% for *T. trichiura* infections. This study agrees with that of Agbolade, et al. [16], who observed a prevalence of (62.8%) for *A. lumbricoides*, 16.6% for Hookworms infections in villages of Ijebu North, Ogun State, Nigeria. The relative lower prevalence of *T. trichiura* and hookworm infection in this study area is in line with previous reports. This is an expected finding as infective hookworm larvae in the soil are much more dependent on soil composition and moisture content of the soil [17].

In this study, it was observed that multiple infections occurred in about 40 children, thus accounting for a 13.3% of the children studied. The level of multiple infection observed (13.3%) was about 4 times lower than what was reported from Igbede community of southern Nigeria [2], and 3 times lower than southwest Ethiopia [18]. The reason for the differences remains unclear, though, it is reasonable to infer that the difference in levels of personal hygiene, socio-demographic and environmental conditions may be implicated for the observed difference in poly-parasitism. Also there have been inconsistent figures on multiple parasitisms. However, that multiple parasitic infections were highest for the combination of *A. lumbricoides* and Hookworms infections, is in consonance with other studies from western Nigeria [5], and that from southern Nigeria [2].

Although, the observed age related prevalence shows that children within age group 0-5 years consistently had highest prevalence for all helminth infections, the prevalence gradually decreases with increase in age of the children. The trend in the prevalence of helminthes parasite among age group 0-5 years suggest a common pattern of behavior and susceptibility as children

within this age groups probably spend more time playing where they often come in contact with infected soil. More so, they tend to eat indiscriminately sometimes with unwashed hands [2].

In this study, the impact of source of water use and faecal disposal on the prevalence of geo-helminth infection among the children were assessed. It was observed that infection rate was highest for those children using stream water for domestic activities and least for those using pipe borne water. While the prevalence was highest for those using nearby bushes as defecation sites compared to those using water closet. This is an expected finding and it conforms to the report of Mbanuga and Abazie [19] among others

5. STUDY LIMITATION AND STRENGTH

This study on purpose did not report other intestinal parasitic infection (that will be reported elsewhere). Some risk factors such as but not limited to socio-economic factors were not evaluated in the current study. Previous study by Nmor, et al. [2] had evaluated the anthropogenic factors for geo-helminth infection in a distant community from this study area. It was not impossible for the slight geographical and cultural difference to impact on the risk factors. Future study should consider evaluating other risk factor that may be sustaining transmission in this population. Due to logistic problem, this study considered small sample size. It is possible that this may have limited the findings from this study. Furthermore, it was not possible to administer anti-helminth drugs to the infected children due to lack of funding. Besides these limitations, this study is the first to report on the prevalence and pattern of geo-helminth infections in this area. Given the high prevalence observed, this study has identified at risk population who could benefit from health education, promotion of good personal hygiene, improvement in sanitation, provision of safe drinking water and possibly mass treatment.

6. CONCLUSION

The high prevalence of geo-helminth infections observed in this study suggests that parasitic infections are public health problems among this population. Also, it was found that *A. lumbricoides*, hookworm and *T. trichiura* are the common helminths that cause parasitic infection in the study area. Chronic intestinal helminthes infections in a vulnerable population like children will not only affect their health, but will also expose them to secondary infections. During on site investigation, it was evident that poor hygiene, environmental sanitation, lack of sufficient pipe borne water among others may be influencing geo-helminth transmission in the study area. Thus, efforts to reduce intestinal parasites should focus on reducing exposures. Improvement in domestic water supplies with the introduction of piped sewerage system together with better sanitation and monitoring can be good strategies to control these infections in the area.

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