

Prevalence Of Intestinal Parasitic Worms In School-Aged Children In The Localities Of Awae, Esse, Mfou And Nkolafamba Of Mefou And Afamba Division, Yaounde-Cameroon; Relationships To Environmental And Behavioural Risk Factors

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Abstract: The main aim this research was to investigate the prevalence of protozoa and helminth infection among school-aged children in Mefou and Afamba Division, Yaoundé-Cameroon and to evaluate the association between the environmental and behavioural risk factors and actual disease prevalence.

This study was a cross-sectional and was carried out from June 2026 to August 2026 in four localities of the Mefou and Afamba Division in the Centre region of Cameroon.

School-aged children within the communities were recruited for the study. Stool samples were collected and analyzed using the wet mount and kato-katz methods to determine the children's disease prevalence. Questionnaires following the environmental and behavioural risk factors were administered to evaluate the risks associated to the diseases.

A total of 416 children from the communities participated in this study. 204 (49 %) were female and 212 (51 %) were male. Protozoa and helminth infection both showed a total prevalence of 5.3%. When compared amongst the four villages, the prevalence of helminth was highest in Nkolafamba (15.8) followed by Esse (3.9%) while Awae and Mfou both had 0%. Comparing the prevalence of protozoa, Esse had the highest (9.8%) followed by Awae (8%), Mfou (4%) and Nkolafamba (0%). Environmental and behavioural risk factors for protozoans and helminths were identified. Drinking unsafe water, using and sharing poor toilet types, poor disposal of household solid waste, infrequent hand washing with soap and rarely or only taking deworming medication when sick were found to promote the diseases.

The presence of parasites in apparently healthy children indicates the continuous presence of reservoirs for disease transmission. The low prevalence of intestinal parasites in these localities could be an indication that the mass drug administration of anthelmintics is an effective strategy reducing the disease burden. Insights from this study are essential for the implementation of successful, sustainable and targeted health-promotion strategies to improve the health and well-being of children.

Keywords: Protozoa and helminth infection, school-aged children, Wet mount and Kato-Katz, Risk factors, Awae, Esse, Mfou and Nkolafamba, Yaounde

1. INTRODUCTION

Intestinal parasitic infections are Neglected Infectious Diseases of public health concerns (such as abdominal disorders, retarded growth, and impairment of cognitive skill in young children) and serious economic problems in several subtropical and tropical countries (Hunter, 2003 and Nkengazong *et al.*, 2016). These diseases still affect several million people with the prevalence rate in endemic areas ranging from 30-60% (Amoah, 2007). They are among the most common infections which heavily affect the poorest and most deprived communities where sanitation is inadequate and water supplies are unsafe (WHO, 2014, and Bopda *et al.*, 2016).

Human parasitic helminths and protozoans are transmitted through fecal contamination of drinking water (Ajeagah *et al.*, 2016), soil (Gamboa *et al.*, 2003) and food (Ajeagah and Fotseu 2019). These neglected intestinal parasitic infections are the most common infections worldwide, especially in developing countries where poverty prevails, sanitary habits are poor or non-existent and where more health awareness and care are needed (Bethony *et al.*, 2006 and Scott *et al.*, 2010). Over the years, soil transmitted helminths (STHs) have shown overwhelming morbidity rates depending on the type of parasite and conditions of the host (Mohammed *et al.*, 2015). Recent evaluations indicate that the STHs: *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), *Necator americanus*, and *Ancylostoma duodenale* (hookworm) infect approximately 2 billion people (24% of the world's population) worldwide (Jourdan *et al.*, 2018). Generally characterized as diarrheic agents in nature, the most common pathogenic protozoans are *Giardia duodenalis* (intestinalis), *Entamoeba histolytica*, *Cryptosporidium* spp., *Cyclospora cayetanensis*, and Microsporidia. Epidemiologically, it is well-known that though individuals of all ages harbour worms, the highest rates occur among school aged children of the tropical and subtropical areas (Nkengazong *et al.*, 2016). This can be explained by their behaviour since their interaction with soil and objects in their surroundings goes with little or no supervision (Hailegebriel, 2017).

Cameroon, just like any other country in the developing world, is faced with the problem of gastrointestinal parasitic infections. An estimated 10 million people are infected with varying prevalence rates in all ten regions of the country (Nkengazong *et al.*, 2016). Despite the adoption of the national program for the control of schistosomiasis and soil transmitted helminthiasis by the ministry of public health, the prevalence of these diseases still persists (Tchuem Tchuente *et al.*, 2013). These infections are associated with favourable qualities of the soil and repeated contamination of the environment by human fecal samples which may contain helminth eggs/larvae and protozoan oocysts/cysts (Blondo, 2014). Fecal contamination of drinking water, soil and food are usually affiliated to the non-respect of sanitary rules, improper personal hygiene and poor construction of toilets which usually empty themselves into small rivers especially in the ghetto neighbourhoods amongst others (Matsinkou *et al.*, 2021).

Our research question was that what is the prevalence of intestinal parasitic worm infections among school-aged children in Awaé, Esse, Mfou, and Nkolafamba of Mefou and Afamba Division, Yaoundé-Cameroon, and how is infection associated with environmental and behavioural risk factors?

We hypothesized that there will be a biodiversity of intestinal parasitic worms in these children and we therefore aimed to find out the prevalence of intestinal pathogenic protozoans and helminths in the localities of Mefou and Afamba Division and their relationships to environmental and behavioural risk factors.

2. MATERIALS AND METHODS

2.1. Description of study sites

The study was carried out from June to August 2026 in four selected neighbourhoods of peri-urban and urban areas of the Mefou and Afamba Division. Mefou and Afamba is a division within the Centre region of Cameroon. The division covers an area of 3,358 km² and an approximate total population of 89,805. The capital of the department lies at Mfou. The four sites are Awaé, Esse, Nkolafamba and Mfou where stool samples were collected from school-aged children from the communities.

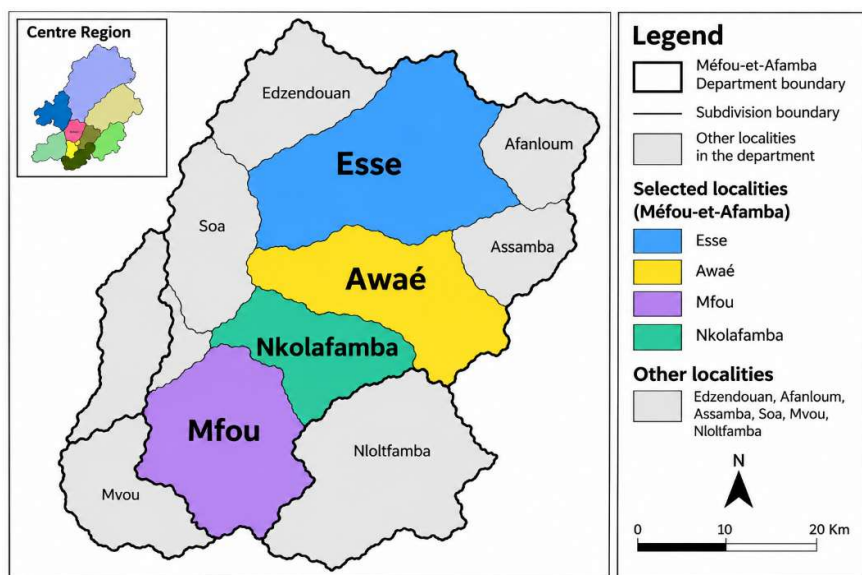


Figure 1: Map of the study site

2.2. Approach used to include study participants

In this study, we included all school aged children between three and seventeen years old within the communities whose parents accepted and signed their informed consent forms to let them participate. For children above fourteen years, they had to sign the assent form provided for them to be included in the study. Children who were not residents of the study sites for at least four weeks prior to the study were not included.

2.3. Theoretical framework and survey instrument

A questionnaire was designed and administered to the participants in order to collect information on the environmental and behavioural risk factors. The study questionnaire consisted of 15 closed ended questions that aimed to collect the following information from children: 5 items on demographics (such as age, gender, school, class, residence), 3 items on water supply (main source of drinking water for the household, whether the drinking water is treated before consumption and the method used), 3 items on toilet types and sanitation (type of toilet facility used by the household, whether this toilet facility is shared with other households and how household solid waste is being disposed of) and 4 items on hygiene and behavioural habits (regarding whether the child washes their hands with soap, the frequency, whether the child wears shoes/sandals when going outside and how often the child receives deworming medication).

2.4. Environmental and Behavioral Questionnaire Scoring

Water supply and treatment

There was a comparison made between the main source of drinking water and the presence of protozoans and helminths, the frequency for which the drinking water is treated before consumption and the method used for the treatment.

Sanitation and waste disposal

A comparison was also made between the type of toilet facility used by the household and the presence of protozoans and helminths. Also, the sharing of the toilet facility with other households and method of household solid waste disposal was compared with parasites presence.

Hygiene and behavioral practices

A comparison was established between the practice of hand washing with soap and the presence of parasites. The wearing of shoes when playing outside and the frequency of receiving deworming medication was also compared with risk of parasite infections.

2.5. Data and sample collection

Prior to stool collection, children were given brief information on the disease (causes, manifestations, consequences, and diagnosis). After registration, the children were given plastic stool sample bottles (with scoop incorporated) and asked to put a scoopful (about 3g) of faecal matter into the containers and return to the researchers. About 3mg/g of sodium azide was added into each container and was stirred. This was to prevent the decomposition of parasite eggs. The stool samples were stored in an ice packed flask and then transported to the laboratory of epidemiology of parasites and clinical research in the institute of medical research and medicinal plant studies (IMPM), Yaoundé for analysis.

2.6. Laboratory analysis

The samples were analyzed using two methods: the wet mount for direct microscopic examination for protozoan cysts and the Kato-katz faecal technique (WHO, 1991) for the identification of helminths eggs following their morphology (*A. lumbricoides*, *T. trichiura*, *S. mansoni* and Hookworm), and larva stage (*S. stercoralis*) (Tanowitz *et al.*, 1993). To minimize the measurement bias on the parasitological data, all slides were read within 24 hours of preparation to avoid the degeneration of Hookworm eggs.

2.7. Data analysis

Statistical package for social science (SPSS) version 20.0 were used to analyze the collected data. Pearson's Chi-square test was used where necessary to compare the prevalence in relation to sex, age groups and villages as well as the relationships between the risk factors and infections. A p-value of less than 0.05, was considered significant in all tests.

2.8. Ethical statement

This study received ethical and administrative clearances from the Institute of Medical Research and Medicinal Plants Studies (IMPM) institutional review board (N/Ref.: 087/82 62/MINRESI/M000). In addition, an information sheet and informed consent form were presented to parents of the children in targeted sites before the study. A written consent was obtained from every parent who desired that their child(ren) participate in the study. Only children whose parents signed and returned the informed consent form and who assented were enrolled in the study.

3. RESULTS

3.1. Socio-Demographic Characteristics

A total of 416 school-aged children from the communities participated in this study. Of these, 204 (49 %) were females and 212 (51 %) were males. The average age of the participants was about 10 years old. The participants were enrolled ranging from ages 3 to 17. Below the age of 5, we had a total of 82 (19.7%), 162 (38.9%) between the age of 5 and 9 and 172 (41.3%) having the age of 10 and above. Amongst the participants, 100 (24%) were from Awae village, 102 (24.5%) from Esse, 100 (24%) from Mfou and 114 (27.5%) from Nkolafamba (Table I).

Table I. Socio-demographic characteristics of the participants according to settings

		Overall	Villages			
			Awae (%)	Esse (%)	Mfou (%)	Nkolafamba (%)
Participants		416	100 (24)	102 (24.5)	100 (24)	114 (27.5)
Age group (years)	<5	82 (19.7%)	14 (14)	20 (19.6)	18 (18)	30 (26.3)
	5-9	162 (38.9%)	32 (32)	46 (45.1)	48 (48)	36 (31.6)
	≥10	172 (41.3%)	54 (54)	36 (35.3)	34 (34)	48 (42.1)
Sex	Female	204 (49%)	68 (68)	52 (50.98)	42 (42)	42 (36.8)
	Male	212 (51%)	32 (32)	50 (49.02)	58 (58)	72 (63.2)

The results obtained from the responses in the questionnaires in the four localities are summarized in table II below.

Table II. Responses from the questionnaires

Variable	Responses	n (%)	Awae (%)	Esse (%)	Mfou (%)	Nkolafamba (%)
Main source of drinking water	Protected well or borehole	408 (98.1%)	96 (96)	98 (96)	100 (100)	114 (100)
	Tap water	6 (1.4%)	4 (4)	2 (2)	0 (0)	0 (0)
	Unprotected well or spring	2 (0.5%)	0 (0)	2 (2)	0 (0)	0 (0)
Drinking water treated before consumption	Yes	12 (2.9%)	0 (0)	12 (11.8)	0 (0)	0 (0)
	No	404 (97.1%)	100 (100)	90 (88.2)	100 (100)	114 (100)
Frequency of treatment	Always	2 (16.7%)	/	2 (16.7)	/	/
	Sometimes	10 (83.3%)	/	10 (83.7)	/	/
Method used for treatment	Bleach/Chlorine	8 (66.7%)	/	8 (66.7)	/	/
	Decantation/Settling	2 (16.7%)	/	2 (16.7)	/	/
	Filtration	2 (16.7%)	/	2 (16.7)	/	/
Type of toilet facility	Flush toilet	38 (9.1%)	4 (4)	14 (13.7)	12 (12)	8 (7)
	Open pit latrine without slab	4 (1%)	0 (0)	4 (3.9)	0 (0)	0 (0)
	Traditional pit latrine with slab	54 (13%)	10 (10)	44 (43.1)	0 (0)	0 (0)
	Ventilated	320 (76.9%)	86 (86)	40 (39.2)	88 (88)	106 (93)

	improved pit latrine					
Sharing of toilet facility	Yes	184 (44.2%)	44 (44)	46 (45.1)	56 (56)	38 (33.3)
	No	232 (55.8%)	56 (56)	56 (54.9)	44 (44)	76 (66.7)
Household solid waste disposal	Buried or burned	306 (73.6%)	70 (70)	76 (74.5)	88 (88)	72 (63.2)
	Dumped in the backyard	50 (12%)	26 (26)	2 (2)	4 (4)	18 (15.8)
	Public garbage bin	60 (14.4%)	4 (4)	24 (23.6)	8 (8)	24 (21.1)
Washing of hands with soap	Always	352 (84.6%)	94 (94)	64 (62.7)	84 (84)	110 (96.5)
	Sometimes	64 (15.4%)	6 (6)	38 (37.3)	16 (16)	4 (3.5)
Wearing of shoes/sandals when going outside	Always	402 (96.6%)	100 (100)	88 (86.3)	100 (100)	114 (100)
	Never	2 (0.5%)	0 (0)	2 (2)	0 (0)	0 (0)
	Sometimes	12 (2.9%)	0 (0)	12 (11.8)	0 (0)	0 (0)
Taking deworming medication	Every 6 months	116 (27.9%)	8 (8)	50 (49)	30 (30)	28 (24.6)
	Once a year	24 (5.8%)	2 (0)	6 (5.9)	8 (8)	8 (7)
	Only when sick	272 (65.4%)	90 (90)	42 (41.2)	62 (62)	78 (68.4)
	Rarely/never	4 (1%)	0 (0)	4 (3.9)	0 (0)	0 (0)

3.2. Helminth and Protozoa Prevalence amongst participants

Table III, shows the prevalence of protozoans and helminth infection amongst asymptomatic children in the four localities. Protozoa prevalence in general was 5.3% (22/416) and helminth prevalence in general was also 5.3% (22/416). When categorized based on the different localities, Esse had the highest protozoa prevalence with 9.8% followed by Awae with 8%, Mfou with 4% and finally Nkolafamba with 0%. As for helminth prevalence, Nkolafamba had 15% followed by Esse with 4% while both Awae and Mfou had 0%.

Schistosoma mansoni was the only prevalent helminth infection seen in Nkolafamba. Other helminth parasites seen elsewhere were *Ascaris lumbricoides* and *Enterobius vermicularis*. As for the presence of protozoans, *Entamoeba coli* was the most prevalent followed by *Entamoeba histolytica* and *Giardia lamblia*.

Table III. Prevalence of protozoans and helminth infection amongst participants in the four localities

		Overall (%)	Awae	Esse (%)	Mfou (%)	Nkolafamba (%)	P
Helminth (n=416)	Negative	394 (94.7)	100 (100)	98 (96.1)	100 (100)	96 (84.2)	<0.001
	Positive	22 (5.3)	0 (0)	4 (3.9)	0 (0)	18 (15.8)	
Protozoa (416)	Negative	394 (94.7)	92 (92)	92 (90.2)	96 (96)	114 (100)	0.0064
	Positive	22 (5.3)	8 (8)	10 (9.8)	4 (4)	0 (0)	
Type of protozoans seen (22)	<i>E. coli</i>	16 (72.7)	6 (6)	8 (7.8)	4 (4)	0 (0)	0.0306
	<i>E. histolytica</i>	4 (18.2)	0 (0)	4 (3.9)	4 (4)	0 (0)	0.006
	<i>G. lamblia</i>	2 (9.1)	2 (2)	0 (0)	0 (0)	0 (0)	0.0957
Types of helminths seen (22)	<i>A. lumbricoides</i>	4 (18.2)	0 (0)	4 (3.9)	0 (0)	0 (0)	0.006
	<i>S. mansoni</i>	16 (72.7)	0 (0)	0 (0)	0 (0)	16 (14.03)	<0.001
	<i>E. vermicularis</i>	2 (9.1)	0 (0)	0 (0)	0 (0)	2 (1.8)	0.1496

3.3. Protozoa and Helminth prevalence in relation to associated environmental and behavioural risk factors (EBRF)

Given that the infectious diseases: Protozoans and helminths are transmitted favourably in areas of poor hygiene practices, we sought to evaluate basic hygiene practices in relation to the diseases. Table IV below summarizes the relationships between the EBRF and helminth prevalence while table V shows the relationships between the EBRF and protozoa prevalence.

Table IV: Relationships between the EBRF and Helminth prevalence

		Positive (%)	Negative (%)	P value
Main source of drinking water	Protected well or borehole	22 (5.4)	386 (94.6)	0.7963
	Tap water	0 (0)	6 (100)	
	Unprotected well or spring	0 (0)	2 (100)	
Frequency of treatment before consumption	Always	0 (0)	2 (100)	0.0209
	Sometimes	0 (0)	10 (100)	
Method used for treatment	Bleach/chlorine	0 (0)	8 (100)	0.0498
	Decantation/settling	0 (0)	2 (100)	
	Filtration	0 (0)	2 (100)	

Type of toilet facility	Flush toilet	2 (7.1)	26 (92.9)	0.8247
	Open pit latrine without slab	0 (0)	4 (100)	
	Traditional pit latrine with slap	4 (7.4)	50 (92.6)	
	Improved pit latrine	16 (5)	304 (95)	
Sharing of the toilet facility	Yes	14 (7.6)	170 (92.4)	0.0597
	No	8 (3.4)	224 (96.6)	
Household solid waste disposal	Buried or burned	16 (5.2)	290 (94.8)	0.7434
	Backyard/open space	4 (8)	46 (92)	
	Public garbage bin	2 (3.4)	56 (96.6)	
Hand washing with soap	Always	20 (5.7)	332 (94.3)	0.5517
	Sometimes	2 (3.1)	62 (96.9)	
Taking deworming medication	Every 6 months	0 (0)	116 (100)	0.0238
	Once a year	2 (8.3)	22 (91.7)	
	Only when sick	20 (7.4)	252 (92.6)	
	Rarely/never	0 (0)	4 (100)	

Table V: Relationships between the EBRF and protozoa prevalence

		Positive (%)	Negative (%)	<i>P</i> value
Main source of drinking water	Protected well or borehole	22 (5.4)	386 (94.6)	0.7963
	Tap water	0 (0)	6 (100)	
	Unprotected well or spring	0 (0)	2 (100)	
Frequency of treatment before consumption	Always	0 (0)	2 (100)	0.0209
	Sometimes	0 (0)	10 (100)	
Method used for treatment	Bleach/Chlorine	0 (0)	8 (100)	0.0498
	Decantation/settling	0 (0)	2 (100)	
	Filtration	0 (0)	2 (100)	
Type of toilet facility	Flush toilet	0 (0)	28 (100)	<0.001
	Open pit latrine without	0 (0)	4 (100)	

	slab			
	Traditional pit latrine with slab	12 (22.2)	42 (77.8)	
	Improved pit latrine	10 (3.1)	310 (96.9)	
Sharing of the toilet facility	Yes	18 (9.8)	166 (90.2)	<0.001
	No	4 (1.7)	228 (98.3)	
Household solid waste disposal	Buried or burned	16 (5.2)	290 (94.8)	0.0492
	Backyard/open space	6 (12)	44 (88)	
	Public garbage bin	0 (0)	58 (100)	
Hand washing with soap	Always	10 (2.8)	342 (97.2)	<0.001
	sometimes	12 (18.8)	52 (81.2)	
Taking deworming medication	Every 6 months	4 (3.4)	112 (96.6)	0.6496
	Once a year	2 (8.3)	22 (91.7)	
	Only when sick	16 (5.9)	256 (94.1)	
	Rarely/Never	0 (0)	4 (100)	

4. DISCUSSION

In this study, we determined the prevalence of protozoa and helminth infection among asymptomatic school-aged children in four villages of Mefou and Afamba division, Cameroon, assessed the environmental and behavioural risk factors, and evaluated the association between these factors and the disease burden/prevalence. The endemic nature of the diseases and the negative impact they have on learning outcomes of pupils were the main reasons for our interest (Sumbele *et al.*, 2015). The socio demographic characteristics of our respondents showed that most were using improved pit toilets which were shared with other households thereby predisposing them to unhygienic conditions and increased risk of disease. Also, most of them could only take deworming medications only when sick.

4.1. Disease Burden/ Parasite Infection

Our results showed that both the overall prevalence of protozoa and helminth was 5.3% but differed when comparing amongst the different localities. This low prevalence is related to similar research which was done in Yaounde with a prevalence of 4% (Ebogo-Belobo *et al.*, 2024). There was however a study done in Awae, Yaounde with a high prevalence of 72% (Koga Mang *et al.*, 2026). The prevalence of protozoa when compared amongst the four localities showed a statistically significant difference with Esse being highest with 9.8%, followed by Awae with 8%, Mfou with 4% and Nkolafamba with 0%. This is probably because Nkolafamba and Mfou are more urbanized than the other two localities and so practice better hygiene and sanitation (Mohammed *et al.*, 2015). Also, the prevalence of helminth when compared amongst the four localities showed a statistically significant difference but this time, Nkolafamba was highest with 15% followed by Esse with 3.9%, while Awae and Mfou both had 0%. Here Nkolafamba has a water point with intermediate hosts of schistosomiasis and so the disease is prevalent in the area.

The protozoans identified in the different localities were *Entamoeba coli*, *Entamoeba histolytica* and *Giardia lamblia*. Both *E. coli* and *E. histolytica* had a significant statistical difference between the four localities while *G. lamblia* was only present in

Awae with prevalence of 2% (Table III). *E. coli* was highly prevalent than the other two species because it is less pathogenic and most of those infected are unaware and so do not seek for treatment (Gyang *et al.*, 2019).

As for the helminths present, we identified three species which were *Ascaris lumbricoides*, *Schistosoma mansoni* and *Enterobius vermicularis*. *A. lumbricoides* and *S. mansoni* both had significant statistical difference in prevalence when compared amongst the four localities while *E. vermicularis* was identified only in Nkolafamba. This is could be due to the reason stated above that *S. mansoni* is prevalent in Nkolafamba and is not affected by the widely distributed anthelmintics but which works well to clear the other helminths identified (Hailegebriel, 2017).

4.2. Risk factors and parasite prevalence

Having low risk factors such as good source of drinking water, modern and clean toilet, frequent hand washing with soap and taking deworming medication regularly is essential for preventing oneself and others from diseases.

Helminth and Protozoa

There was no significant difference between the main source of drinking water and helminth prevalence as well as protozoa prevalence. This is probably because majority of the participants used protected well/borehole and tap water for drinking (Matsinkou *et al.*, 2021). As for the participants who used to treat their water before drinking and helminth and protozoa prevalence, there was a significant difference between those that do so always and those that do so only sometimes ($p=0.0209$). Concerning the method used for the treatment of drinking water and presence of helminth as well as protozoa, there was a significant difference between the use of bleach/chlorine, decantation/settling and filtration (0.0498) (Table IV and V). The is probably because using bleach and/or chlorine for water treatment is more effective for parasite prevention than the others (Blondo, 2014).

Concerning the type of toilet facility used and helminth prevalence, there was no statistically significant difference between the different toilet types ($p=0.8247$) and also between toilet sharing with other households ($p=0.597$) (Table IV). But as for the type of toilet facility and protozoa prevalence, there was a statistically significant difference between the different toilet types ($p<0.001$) as well as between toilet sharing with other households ($p<0.001$) (Table V). This is because the majority of those positive for protozoa used tradition pit latrine and did share their toilets with other households unlike the case with those screened for helminths (Blondo, 2014).

As for the method used for household solid waste disposal and the presence of helminth, there was no statistically significant difference between the different methods used ($p=0.7434$) unlike the case with protozoa presence which had a statistically significant difference between the different methods used ($p=0.0492$). This is probably because none of those who responded to dispose their solid waste through the public garbage bin which is the safest method was positive for protozoa but as for the comparison with helminth presence, two persons were positive (Bareket and Zewdneh, 2015).

As for the washing of hands with soap and the presence of helminth, there was no statistically significant difference between those that do so always and those that do so only sometimes ($p=0.5517$). But the situation is different with the washing of hands with soap and the presence of protozoa as there was a statistically significant difference between the frequency ($p<0.001$) as this agrees with a similar study done in Ethiopia (Hailegebriel, 2017). This is probably because the majority of those who were positive with protozoa wash their hands only sometimes with soap unlike the situation when comparing with helminth where the majority always wash their hands with soap as reported elsewhere (Shahrul *et al.*, 2012).

Finally, when comparing whether the child receive deworming medication and the presence of helminths, there was a statistically significant difference between the different durations mentioned ($p=0.0238$) (Table IV) unlike the situation when comparing with protozoa presence (0.6496) (Table V). This is probably because deworming medications shared mostly in school clear helminth infections but do not work against protozoa infections (Gyang *et al.*, 2019).

5. CONCLUSION

Our study revealed a biodiversity of protozoa and helminth among asymptomatic school-aged children in the localities. The presence of parasites in apparently healthy children indicates that there is continuous presence of reservoirs for the disease transmissions. The low prevalence of intestinal parasitic worms in the localities could be due to the mass drug administration of anthelmintics which is an effective strategy reducing the disease burden. On the other hand, our results showed that the environmental and behavioural risk factors are the reasons why the diseases still remain in the communities. These findings suggest that, our call for special health education programs on tropical diseases in school curricular should emphasize topics on protozoans and helminths. This information can be used by the Ministry of Public Health and the Ministry of Basic Education to raise better awareness to the participants on how to reduce the risks of infection.

6. STUDY LIMITATIONS

Most of the parents or guardians of these school-aged children refused to give their consent for the children to participate in the study thereby reducing a significant coverage of the study sites.

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COMPETING INTERESTS

All authors have declared that no competing interests exist.

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