

# Prevalence of Intestinal Protozoans among Schoolchildren in Suburban Areas near Yangon, Myanmar

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**Abstract:** Although intestinal protozoans are common etiologies of diarrhea, few studies have been conducted in Myanmar. This study planned to investigate the prevalence of *Giardia lamblia*, *Entamoeba coli*, *Entamoeba histolytica*, and *Endolimax nana* among schoolchildren and their guardians in suburban areas near Yangon, Myanmar. We performed a cross-sectional survey among schoolchildren and their guardians from 7 primary schools in South Dagon and Hlaing Thar Yar districts, Yangon, Myanmar. Stool samples were observed with a microscope after concentration technique and iodine staining. Total 821 stool samples, including 556 from schoolchildren and 265 from guardians, were examined. The median age was 6 years old for schoolchildren and 36 years old for guardians. A 53.1% of the school children and 14.6% of the guardians were males. The overall prevalence of each intestinal protozoan species was as follows: 3.4% (28/821) for *G. lamblia*; 3.5% (29/821) for *E. coli*; 1.2% (10/821) for *E. histolytica*, and 3.0% for *E. nana*. This study showed that intestinal protozoans are common in primary schoolchildren and their guardians in suburban areas near Yangon, Myanmar. Health interventions, such as hand washing education, improvement of sanitation, and establishment of water purification systems are urgently needed in this area.

**Key words:** *Giardia lamblia*, *Entamoeba histolytica*, *Entamoeba coli*, *Endolimax nana*, prevalence, schoolchildren, Myanmar

Diarrheal diseases are important causes of morbidity and mortality in young children [1]. Diarrhea can be caused by various pathogens, including bacteria, viruses, and protozoans. Among the protozoans, *Cryptosporidium* species, *Giardia lamblia* (synonymous with *G. duodenalis* and *G. intestinalis*) and *Entamoeba histolytica* are well known etiologies of the human diarrheal diseases [2]. These protozoans are distributed worldwide and more prevalent in areas with poor sanitation, including southeastern Asia [3,4]. Although a previous study reported the prevalence of intestinal protozoans from the Burmese immigrants working in Thailand, the infection status of Burmese people residing in Myanmar with these protozoans has not been known [5]. In this study, we performed a cross-sectional survey to identify the prevalence of intestinal protozoans among Burmese people near Yangon, Myanmar.

The study participants were schoolchildren and their guard-

ians from 7 primary schools in South Dagon and Hlaing Thar Yar district, Yangon, Myanmar (Fig. 1), and the study was done in 2015. Stool samples were collected from the participants, 1 sample per person, and fixed with sodium acetate-acetic acid-formalin (SAF) solution. The mixture was filtered through gauze and centrifuged at 800 g for 10 min twice. The sediment was finally fixed with a small amount of 10% formalin and moved onto a slide glass. The slides were observed under a microscope after iodine staining. The cysts of intestinal protozoans, such as *G. lamblia*, *E. histolytica*, *Entamoeba coli*, and *Endolimax nana* were identified according to their typical morphologies.

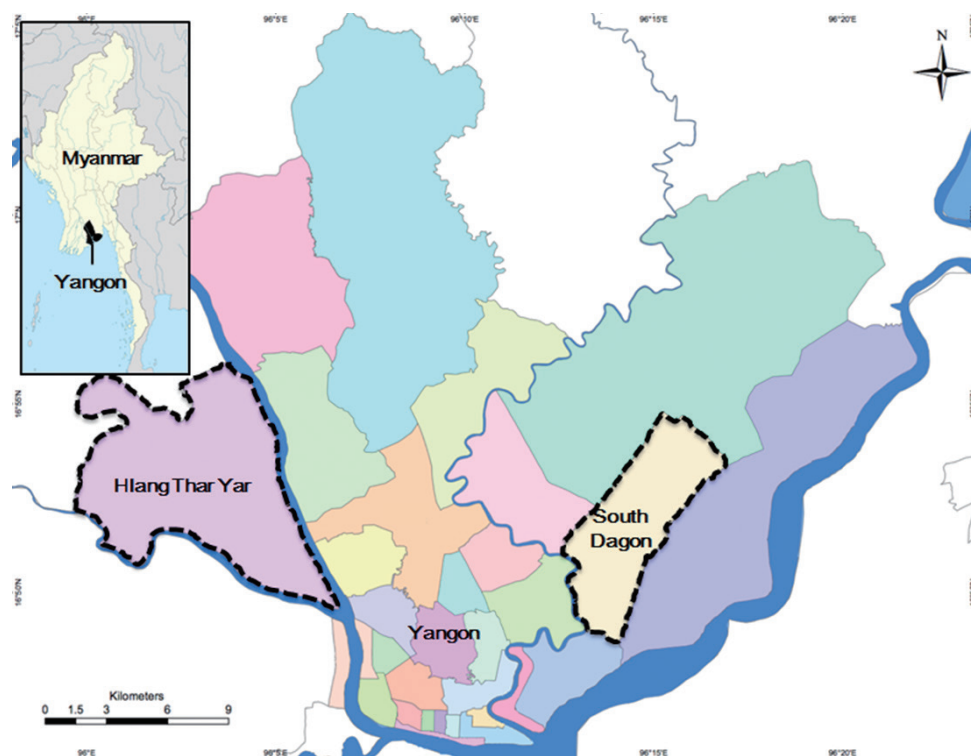
A total of 821 people consisting of 556 schoolchildren and 265 guardians submitted their stool samples (Table 1). The median age was 6 years (interquartile range, IQR: 5-7) for the schoolchildren and 36 (IQR: 30-41) for the guardians. With regard to gender, 53.1% of the schoolchildren and 14.6% of the guardians were males. The overall positive rate for protozoan cysts was 10.0%; the rate was 10.6% for schoolchildren and 8.7% for guardians (Table 2). Among the schoolchildren, the prevalence of each protozoan species was as follows: 4.3% (24/556) for *G. lamblia*, 3.1% (17/556) for *E. coli*, 3.1%

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**Fig. 1.** Map showing the study location, suburban areas of Yangon, Myanmar. Seven primary schools in the 2 communes (South Dagon and Hlaing Thar Yar) were included in this study.

**Table 1.** Demographic characteristics of the study population

	Schoolchildren (%)	Guardians (%)	Total (%)
Enrolled no.	556 (67.7)	265 (32.3)	821 (100.0)
Age <sup>a</sup>			
Median; IQR	6; 5-7	36; 30-41	
Sex <sup>b</sup>			
Male	292 (53.1)	23 (14.6)	315 (44.5)
Female	258 (46.9)	135 (85.4)	393 (55.5)

IQR, interquartile range.

<sup>a</sup>Age information available in 636 participants.

<sup>b</sup>Sex information available in 708 participants

(17/556) for *E. nana*, and 0.9% (5/556) for *E. histolytica*. In comparison, among the guardians, the prevalence was 4.5% (12/265) for *E. coli*, 3.0% (8/265) for *E. nana*, 1.9% (5/265) for *E. histolytica*, and 1.5% (4/265) for *G. lamblia* (Table 2). In South Dagon, the schoolchildren in 3 primary schools showed overall prevalences of 7.2-12.7% compared to 6.5-20.0% of schoolchildren in 4 primary schools in Hlaing Thar Yar (Table 3). *G. lamblia* was more prevalent in Hlaing Thar Yar than in South Dagon (7.1% vs 2.0%,  $P=0.003$ ) in schoolchildren. Boys revealed higher prevalences of *E. coli* (4.1% vs 1.8%,  $P=0.006$ ) and *E. histolytica* (1.3% vs 0.5%,  $P=0.035$ ) when

analyzed by the chi-square test.

In this study, we showed that overall 10% of the schoolchildren and their guardians were positive for intestinal protozoans in primary schools near Yangon. Protozoans with human pathogenic potential, such as *G. lamblia* and *E. histolytica*, were also prevalent in 3.4% and 1.2%, respectively. So far as we know, this is the first report on the prevalence of intestinal protozoans among schoolchildren in Myanmar.

The prevalences of intestinal protozoans among schoolchildren in this study were similar to those reported from schoolchildren in Cambodia [6,7]. The prevalences of *G. lamblia* and *E. histolytica* were 2.9-3.2% and 0.8%, respectively, in Cambodia [6,7]. In Thailand, *G. lamblia* was positive in 2.2% of some population in rural provinces and 6.5% of schoolchildren in suburban provinces [8]. Collectively, the prevalences of intestinal protozoans in Myanmar were similar to those from neighboring countries. However, it is of note that Myanmar immigrants working in Thailand revealed a higher prevalence (14.1%) of *G. lamblia* than in this study [5]. This suggests 2 possibilities. One is that intestinal protozoan infections may be more highly prevalent in rural areas of Myanmar (possibly their hometowns), whereas the subjected areas in this study

**Table 2.** Prevalence of intestinal protozoans among primary schoolchildren and their guardians

	Total no. examined	No. (%) positive for any protozoa	<i>E. histolytica</i> (%)	<i>E. coli</i> (%)	<i>E. nana</i> (%)	<i>G. lamblia</i> (%)
Schoolchildren	556	59 (10.6)	5 (0.9)	17 (3.1)	17 (3.1)	24 (4.3)
Guardians	265	23 (8.7)	5 (1.9)	12 (4.5)	8 (8.0)	4 (1.5)
Total	821	82 (10.0)	10 (1.2)	29 (3.5)	25 (3.0)	28 (3.4)

**Table 3.** Prevalence of intestinal protozoans among primary schoolchildren according to school

District	School	Total no. examined	No. (%) positive for any protozoa	<i>E. histolytica</i> (%)	<i>E. coli</i> (%)	<i>E. nana</i> (%)	<i>G. lamblia</i> (%)
Hlang Thar Yar	BEPS 6	54	7 (13.0)	1 (1.9)	3 (5.6)	0 (0.0)	5 (4.8)
Hlang Thar Yar	BEPS 10	45	9 (20.0)	0 (0.0)	2 (4.4)	3 (6.7)	6 (4.8)
Hlang Thar Yar	BEPS 14	77	5 (6.5)	1 (1.3)	1 (1.3)	1 (1.3)	3 (3.9)
Hlang Thar Yar	BEMS 28	76	7 (9.2)	0 (0.0)	0 (0.0)	1 (1.3)	6 (6.7)
South Dagon	BEPS 19	61	7 (11.5)	1 (1.6)	0 (0.0)	5 (8.2)	1 (1.1)
South Dagon	BEPS 21	125	9 (7.2)	0 (0.0)	2 (1.6)	6 (4.8)	2 (1.2)
South Dagon	Ywar Thar Gyi	118	15 (12.7)	2 (1.7)	9 (7.6)	1 (0.8)	3 (2.5)
Total		556	59 (10.6)	5 (0.9)	17 (3.1)	17 (3.1)	24 (4.3)

BEPS, Basic Education Primary School; BEMS, Basic Education Middle School.

were suburban areas near Yangon. Another possibility is that Myanmar immigrant workers were more frequently exposed to fecal-oral contamination of food or water either in specific localities of Myanmar or Thailand.

It is also interesting to see that whereas the overall prevalence was similar between the 2 surveyed districts in this study, *G. lamblia* was more highly prevalent in Hlaing Thar Yar than in South Dagon. In general, intestinal protozoans are considered to be prevalent in areas with poor sanitation and low socioeconomic status. Out of the 2 districts included in our study, South Dagon is generally known as the one with poorer socioeconomic status than Hlaing Thar Yar. Our previous study on *Enterobius vermicularis* identified significantly higher prevalence among children in South Dagon than in Hlaing Thar Yar [9]. Since the results of this study does not agree with this general concept, specific cause of fecal-oral contamination of *G. lamblia* in primary schoolchildren in Hlang Thar Yar district needs to be further elucidated.

Our study has several limitations. First, since cysts of *Entamoeba dispar* and *Entamoeba moshkovskii* have indistinguishable morphology from that of *E. histolytica*, the prevalence of *E. histolytica* could have been overestimated [10]. Second, we could not differentiate symptomatic infections from asymptomatic carrier states due to lack of clinical information. Despite these limitations, our study adds valuable information on the current status of intestinal protozoan infections among the people in Myanmar. The high prevalence of pathogenic protozoa implies that health interventions, such as hand washing

education, improvement of sanitation, and establishment of water purification systems are urgently needed in these areas.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest related to this study.

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