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Intestinal parasitic infections in suburban government schools, Lak Hok subdistrict, Muang Pathum Thani, Thailand

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ABSTRACT

Objective: To provide baseline information of parasitic infections in 3 suburban government schools, Lakhok subdistrict of Muang Pathum Thani, Thailand. **Methods:** This study was conducted between May–June 2010 using simple direct smear and modified formalin ether and from a population of 1 253 in 3 suburban government schools. **Results:** Total samples of 202 registered and participated. The average of prevalence of infection from 3 schools was 13.9%, there were 13.7%, 14.3% and 13.9% in N, S and R school, respectively with no significant difference between schools (P>0.05). The infection rates did not show significant difference between genders (P>0.05). The highest rate of infection was 20.4% in Pathom 2 (8 years) students and the lowest was 4% in Pathom 1 (7 years) with statistically difference between age groups (P<0.05). The highest prevalence of pathogenic protozoa was *Giardia lamblia* (*G. lamblia*) which was found in 50% of infected cases, followed by 25% of *Entamoeba histolytica* (*E. histolytica*) and *Blastocystis hominis* (*B. hominis*). The highest prevalence of non-pathogenic protozoa was *Endolimax nana* (*E. nana*) which was found in 88.9%, followed by 11.1% of *Entamoeba coli* (*E. coli*). Mixed infections between *Blastocystis hominis* (*B. hominis*) and *Endolimax nana* (*E. nana*) were reported at 7.1%. The only helminthic infection found in this study area was hookworm, found in 1 student (3.8%). The formalin ether concentration technique showed a higher efficacy of detection (78%–100%) than the simple direct smear method (0%–50%). **Conclusions:** Surveillance of Protozoan infections may need to be focused on suburban areas.

1. Introduction

More than 2 billion people might be infected with helminths, mainly in the developing world[1]. At the highest risk of morbidity are pre-school and school-aged children and pregnant women[2]. The effects of helminth infections include growth retardation, and delayed intellectual development and cognition[1,2]. Vitamin A deficiency, malabsorption of vitamin B12 and fat and nutritional deficiencies in children might be associated with *Giardia lamblia* (*G. lamblia*)[3]. Morbidity due to *Entamoeba histolytica* (*E. histolytica*) includes diarrhoea and dysentery in children and liver abscess in severe cases[4]. Some studies have suggested an association of *Blastocystis* spp. with acute or chronic digestive disorders such as irritable bowel syndrome (IBS)[5,6]. It is well known that helminthiasis infection is of considerable public health importance in rural Thailand. Some infections study focally in school-age children[7–9].

There were some reports of parasitic infections in central Thailand in 2006 using formalin-ether concentration technique and the results showed the overall prevalence was 4.24%. The pathogenic parasites found were *G. lamblia* (1.25%), *Enterobius vermicularis (E. vermicularis)* (0.19%), *Trichuris trichiura (T. trichiura)* and Hookworm (0.19% each)[10]. Ngrenngarmlert *et al* determined the prevalence of intestinal parasites in children from eight schools located in Phuttamonthon District, Nakhon Prathom Province, and 12.6% were infected with one or more of 10 intestinal parasitic species. The most frequent parasite was *Blastocystis hominis* (*B. hominis*) (6.2%). Other parasites were *G. lamblia* (1.7%) and less than 1% of helminthes[9].

Lak Hok subdistrict is an area around Rangsit University. The policy to provide health services to communities led

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us to analyze community health problems by surveying intestinal parasitic infections which initially started at 3 government schools using simple direct smear and modified formalin-ether technique.

2. Materials and methods

2.1. Study area

A cross-sectional survey was conducted in 3 government schools (N, S and R school) near Rangsit University campus in Lakhok subdistrict, muang Pathum Thani, which is one of the central provinces of Thailand. The subdistrict is just north of Bangkok (Figure 1).

This study was approved by the Ethic Committee of Rangsit University, Pathum Thani, Thailand (RSEC 01/53).

Figure 1. Map of Thailand showing Pathum Thani province and the study conducted in Lak Hok subdistrict (in area 1)[10].

2.2. Subjects and specimen collection

This study was carried out between May-June 2010 in 3 urban government schools, Lakhok subdistrict of Muang Pathum Thani, Thailand. Fecal samples were requested from 1 253 students (7-12 years old). All the participants were asked for their parents to sign a consent form before being enrolled in the study. If the parents and children agree to participate, the procedure for specimen collections was thoroughly explained to the students. The plastic containers were distributed to each student on the day before specimen collection. All specimens were collected in the next morning and brought back to the laboratory at Faculty of Medical Technology, Rangsit University and immediately diagnosed by simple direct smear and the remains were preserved in 10% formalin.

2.3. Fecal examination

From each stool sample, duplicate simple direct smear were prepared on microscope slides shortly after stool collection by two experienced technicians.

In addition, approximately 1-2 g of stool was performed by modified formalin-ether concentration technique which was modified from Richie (1948)[11]. Briefly, 1-2 g of faces was suspended with 10% formalin solution, filtered through one layer of gauze, and centrifuged at 2000 × *g* for 2 min and washed with 10% formalin 2 times; the sediment was suspended with 7 mL of 10% formalin and 3 mL of ether was added, and shaken for 30 s; and the tube was again centrifuged and the sediments were recovered. The sediments were examined for intestinal protozoa, eggs and larvae of intestinal helminthes under a light microscope.

2.4. Data analysis

Data were interpreted the prevalence by descriptive statistics and expressed as percentage (%). All data were classified according to sex, age and school using SPSS and analyzed with a *chi*-square test. *P*-value was considered statistically significant at $P<0.05$.

3. Results

3.1. Study compliance

A total of 202 out of 1 253 children from 3 government school were registered (16.1%). Children's age ranged between 7 and 12 years. There were 54.5% male and 45.5% female.

3.2. Intestinal parasitic infections between sexes and schools

The average rate of infection was 13.9%. When classified by sexes, the infection rate was 14.1% in female and 13.6% in male which equates to no significant difference ($P>0.05$). Intestinal parasitic infection was not found to be different between the 3 schools ($P>0.05$). The infection rates are summarized in Table 1.

Table 1
Intestinal parasitic infections between sexes and schools from 3 urban government schools at Lak Hok subdistrict, Pathum Thani.

School*	No.of infection/ total samples (%)		Total infections/ Total samples (%)
	Male**	Female**	
N (*n*=102)	7/46 (15.2)	7/56 (12.5)	14/102 (13.7)
S (*n*=35)	2/18 (11.1)	3/17 (17.7)	5/35 (14.3)
R (*n*=65)	6/46 (13.3)	3/19 (15.0)	9/65 (13.9)
Total (*n*=202)	15/110 (13.6)	13/92 (14.1)	28/202 (13.9)

* $\chi^2 = 0.589$, $df = 2$, $P = 0.745$; ** $\chi^2 = 0.260$, $df = 1$, $P = 0.610$.

3.2. Intestinal parasitic infections between ages

When classified by age, the children of 8 years (pathom 2) old from 2 schools demonstrated the highest prevalence (about 24%-29%) (Table 2), while those of 7 years (pathom 1) old had the lowest prevalence (about 4.0%), with a significant difference between ages ($P<0.05$).

Table 2
Intestinal parasitic infections between ages and schools from 3 urban government schools at Lak Hok subdistrict, Pathum Thani.

Schools	No. of infections/ Total samples (%)						Total
	P1 (7 years)	P2 (8 years)	P3 (9 years)	P4 (10 years)	P5 (11 years)	P6 (12 years)	
N	0/11 (0.0)	4/26 (15.4)	3/17 (17.7)	3/20 (15.0)	0/5 (0.0)	4/23 (17.4)	14/102 (13.7)
S	0/3 (0.0)	2/7 (28.6)	1/4 (25.0)	0/0 (0.0)	0/10 (0.0)	2/11 (18.2)	5/35 (14.3)
R	1/11 (9.1)	5/21 (23.8)	0/11 (0.0)	2/11(18.2)	1/9 (11.1)	0/2 (0.0)	9/65 (13.9)
Total	1/25 (4.0)	11/54 (20.4)	4/32 (12.5)	5/31(16.1)	1/24 (4.2)	6/36 (16.7)	28/202 (13.9)

P = Primary school (pathom).

3.3. Distribution of intestinal parasites in government school

3.3.1. Protozoan infections

The most prevalent pathogenic protozoan observed was *G. lamblia* (3.0%), followed by *E. histolytica* and *B. hominis* (1.5% each). Non pathogenic protozoa *Endolimax nana* was found predominant (7.9%) and some *E. coli* were present (1%). There were some mixed infections between *Blastocystis hominis* vs *Endolimax nana* (1.0%) and *Giardia lamblia* vs *Endolimax nana* (0.5%) as shown in Table 3.

3.3.2 Helminth infections

Just one child (0.5%) from S school was found with hookworm infection. No other helminthes were found in these urban government schools (Table 3).

3.3.3 The parasite rates using each technique

Using simple direct smear alone, the prevalence rates were 6.9% and using modified formalin-ether concentration alone, the prevalence rates were 10.9% (Table 4). The prevalence of intestinal parasitic infection rate in government school of Lak Hok subdistrict in this study reported at 13.9% by simple direct smear and modified formalin-ether concentration.

Table 3
Distribution of intestinal parasites in government school (*n*=202).

Intestinal parasitic infections	Infected *n* (%)	
Protozoa infection *n*=27		
Pathogen *n*=12	*G. lamblia*	6 (3.0)
	E. histolytica	3 (1.5)
	B. hominis	3 (1.5)
Non Pathogen *n*=18	*E. nana*	16 (7.9)
	E. coli	2 (1.0)
Mix infection *n*=3	*B. hominis*+*E. nana*	2 (1.0)
	G. lamblia +*E. nana*	1 (0.5)
Helminth infections *n*=1	Hookworm	1 (0.5)

Table 4
The parasite rates using each technique (*n* positive=28).

Intestinal parasites	No. of positive (%)	
	Simple smear method	Modified formalin-ether concentration
E. histolytica	0 (0.0)	3 (1.5)
G. lamblia	3 (1.5)	3 (1.5)
B. hominis	1 (0.5)	0 (0.0)
E. coli	2 (1.0)	0 (0.0)
E. nana	7 (3.5)	12 (5.9)
B. hominis vs. E. nana	1 (0.5)	2 (1.0)
G. lamblia vs. E. nana	0 (0.0)	1 (0.5)
Hookworm	0 (0.0)	1 (0.5)
Total	14 (6.9)	22 (10.9)

4. Discussion

The overall prevalence of intestinal parasites in these 3 suburban government schools, Lakhok subdistrict of Muang Pathum Thani was 13.9%, much higher than the previous figure reported by Ngrenngarmlert *et al* who reported the prevalence of 12.6% in school children at Phuttamonthon District using formalin-ethyl acetate concentration[9] and the study from Ministry of Public Health demonstrated the prevalence of parasitic infections in central of Thailand was 5.8% using Kato's thick smear and formalin-ether concentration. However, the rate of infection was still lower than in rural northern (17.7%), northeastern (26.0%) and southern Thailand (19.8%)[12]. The higher prevalence of protozoan infection from this study may imply contaminated protozoa in drinking water or food which should be the focus for warning of protozoan infection in suburban areas, the same as the previous study by Kitvatanachai *et al* who reported protozoa infections in Srimum suburban area of Nakhon Ratchasima province were 17.3% by simple direct smear[13]. The problem of protozoan infection is a chronic disease and most people showed asymptomatic then people had no awareness but it can cause chronic diarrhea[3-6].

The prevalence among children in this study was not

statistically significantly different between male and female and also among schools (P>0.05) the same as the previous study which indicates an equal opportunity for acquiring parasitic infections[9]. The children of 8 years (pathom 2) old have a higher risk of infection (24%-29%) than any other ages, similar to Saksirisampant *et al*[8].

There were 6 species of parasite found in this area. The predominant intestinal parasites in this suburban area were intestinal protozoa while the occurrence of intestinal helminthes was quite low. It is promising that our findings reflect the wide distribution of intestinal protozoa, *G. lamblia* (3.0%), *B. hominis* (1.5%), *E. histolytica* (1.5%) and non pathogen protozoa 8.9% the same as previously reported by Ngrenngarmlert *et al*[9] and Kitvatanachai *et al*[13]. Pathogenesis of *B. hominis* is unclear, a recent study observed acute or chronic digestive disorders such as irritable bowel syndrome (IBS)[5,6] Vitamin A deficiency, malabsorption of vitamin B12 and fat and nutritional deficiencies in children might be associated with *G. lamblia*[3]. Morbidity due to *E. histolytica* includes diarrhoea and dysentery in children and liver abscess in severe cases[4]. Therefore, a control measure for the prevention of giardiasis, blastocystiasis and entamoebiasis should be emphasized before an out break can start. We recommended health education should be implemented for student and they can take it to families. Drinking water and contaminated food may be the source of transmission that should aware.

The low prevalence of helminth infections in this study, just 1 case of hookworm infection, might be due to the urbanization, public investments in basic sanitation, and improvement of general living conditions, and the accessibility to health services.

The prevalence using modified formalin-ether demonstrated higher prevalence (10.9%) than simple direct smear (6.9%). The modified formalin-ether used about 2 g of feces while simple direct smear just 1-2 mg of feces. However, there were some parasites that weren't found by modified formalin-ether but showed results in simple direct smear and also some parasites weren't found by simple direct smear but showed results in modified formalin-ether the same as Uga *et al*[14]. So we recommend using both techniques in future surveys to maximize recovery of the prevalence.

Conflict of interest statement

We declare that we have no conflict of interest.

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