CURRENT INFECTION RATE OF *GIARDIA LAMBLIA* IN TWO PROVINCES OF THAILAND

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Abstract: The aim of this study was to survey for the current rate of *Giardia lamblia* infection in three different districts in two provinces of Thailand, Surin and Samut Sakhon, in March 2002, October 2003, and March 2004. Two districts are rural areas and another is sub-urban. Volunteers of any age from Surin Province and children aged between 5 to 7 years old from three secondary schools in Samut Sakhon were enrolled for the stool examination. The method used was stool examination by both simple smear and normal saline concentration technique on fresh collected feces. All samples were tested in duplicate. Out of 3,358 healthy individuals from rural Surin Province, 75 cases (2.2%) were found positive for *G. lamblia*, 30 of which were below 10 years of age. By comparison, 656 individuals from sub-urban Samut Sakhon Province volunteered and 43 (6.5%) were positive for *G. lamblia*. Other intestinal parasites, both helminth and protozoa, were also identified from these two groups: hookworm, *Enterobius vermicularis*, *Strongyloides stercoralis*, *Trichuris trichiura*, *Taenia* species, *Entamoeba histolytica*, *Entamoeba coli*, *Endolimax nana*, and *Blastocystis hominis*. From this study, the data showed that parasitic infection acquired via fecal-oral route is still a significant problem for these two provinces of Thailand.

INTRODUCTION

Giardiasis is one of the intestinal protozoa that causes public health problems in most developing countries as well as some developed countries. For decades, *Giardia* infection has remained one of the most common causes of waterborne disease (both drinking and recreational water) in humans and almost all vertebrates (Patton and Rabinowitz, 1994; Sulaiman *et al*, 2003; Olson *et al,* 2004). *Giardia* infections are more common in warmer climates, though they may be found worldwide and in every region. In developing countries in Asia, Africa, and Latin America, approximately 200 million people have symptomatic giardiasis and the majority of them are children (Thompson *et al,* 2000). Many infected people can be asymptomatic (Supanaranond *et al*, 1990) which leads to difficulty in the eradication and control of this disease due to the number of potential carriers of *Giardia lamblia.*

Thailand is among those countries in Southeast Asia that has a problem with infectious diseases due to intestinal protozoa. There are several reports on giardiasis showing consistently high prevalence in the rural areas of Thailand (Waikagul *et al,* 2002; Saksirisampant *et al,* 2003; Sirivichayakul *et al*, 2003). High prevalence is believed to be connected with poor sanitation and sub-standard personal hygiene.

In this study, we examined the status of *Giardia lamblia* and other intestinal parasitosis among school-children in Samut Sakhon, a province near Bangkok, and various groups of citizens in Surin, a province about 450 km northeast of Bangkok.

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MATERIALS AND METHODS

Study groups

Six hundred fifty-six schoolchildren from 3 public secondary schools in Krathum Baen district of Samut Sakhon Province were enrolled during November to December 2003, while 1,910 volunteers from Mueang district and 1,448 volunteers from Khwao Sinarin district in Surin Province were studied in March 2002 and 2004, respectively.

All of participants were asymptomatic and healthy at the time of study. A questionnaire on age, sex, family, occupation, hygienic habits etc was filled out and informed consent was obtained from all of the participants.

Parasite examination

Stool samples were collected from volunteers in dry and clean plastic containers with solid lids. The specimens were examined freshly on the same day both macroscopically and microscopically. Microscopic

examination of each fecal specimen from Samut Sakhon Province was performed following normal saline simple sedimentation whereas samples from Surin Province were tested by simple smear. Iodine solution was used for clearer visualization by microscopy. All specimens were tested in duplicate.

Statistics

Data were calculated for p-value using chi-square test in the SPSS software for Windows version 11.0.

RESULTS

A total number of 4,014 subjects were included in this study. The prevalence of *G. lamblia* infection was higher in Samut Sakhon Province with an infection rate of 6.5% compared to 4.4% of Surin (Table 1). There was a significant difference of *Giardia* infection between these two provinces with p-value >0.05. The incidence of *Giardia* infection between the two districts in Surin Province was not significantly different with p-value of 0.104.

In Surin Province, the positive rates of males were 3.2% in Mueang district and 2.8% in Khwao Sinarin district, higher than females in both districts with p-value of 0.045 and 0.005, respectively (Table 2). Boys were infected with *G. lamblia* significantly higher than girls in Samut Sakhon Province with p-value of 0.005 (Table 3).

The positive rate was higher in year 2004 when compared to 2002 in Surin Province (Fig 1). In year 2004, the rate of infection was 2.5, 1.6, 2.7 and 1.5% among people aged 0-15, 16-30, 31-45, and 46-60 years, respectively. On the other hand, in year 2002, the rate of infection was 1.3, 0.3, 0.5, 0.4 and 0.1% in people aged 0-15, 16-30, 31-45, 46-60, and 61-75 years, respectively.

Six other parasites, 2 protozoa and 4 helminths, were also found in the samples from Surin Province in year 2004 (Table 4). Hookworm was the most common parasite (58.7%), and helminthic infections (77.5%) had a higher infection rate than protozoa (22.5%). *Strongyloides stercoralis* and *Opisthorchis* had roughly equal rates of infection, 9.7% and 8.2%, respectively. Of the protozoa, *Giardia lamblia* led the group with 13.8% followed by *Entamoeba coli* (8.2%). The overall positive rate of protozoa parasites was 22.5%.

The intestinal parasites detected from Samut Sakhon Province also included both protozoa (5 species) and helminths (3 species) (Table 5). The most common parasites found were protozoa (92.2%), with *Giardia lamblia* (39.2%) as the highest infective agent followed by *E. coli* (31.4%). *E. histolytica* (5.9%), *E.*

Table 1
Prevalence of *Giardia lamblia* in two districts of Surin Province and Samut Sakhon Province.

Area	Total number	Positive number	%	p-value
Mueang district, Surin	1,910	48	2.5	0.104
Khwao Sinarin district, Surin	1,448	27	1.9	
Krathum Baen district, Samut Sakhon	656	43	6.5	> 0.05
Total	4,014	118	2.9	

Table 2
Prevalence of *Giardia lamblia* in volunteers in Tambon Khaw Koh, Mueang district in March 2002 and Khwao Sinarin district in Surin Province in March 2004.

Sex	Prevalence in Mueang district				Prevalence in Khwao Sinarin district			
	Total no.	Positive no.	%	p-value	Total no.	Positive no.	%	p-value
Male	884	28	3.2	0.045	715	20	2.8	0.005
Female	1,026	20	1.9		733	7	0.9	
Total	1,910	48	2.5		1,448	27	1.9	

Table 3
Prevalence of *Giardia lamblia* in schoolchildren aged 5 to 6 years old in Krathum Baen district, Samut Sakhon Province from November to December 2003.

Sex	Total number	Positive number	%	p-value
Boys	348	33	9.5	0.005
Girls	308	10	3.2	
Total	656	43	6.5	

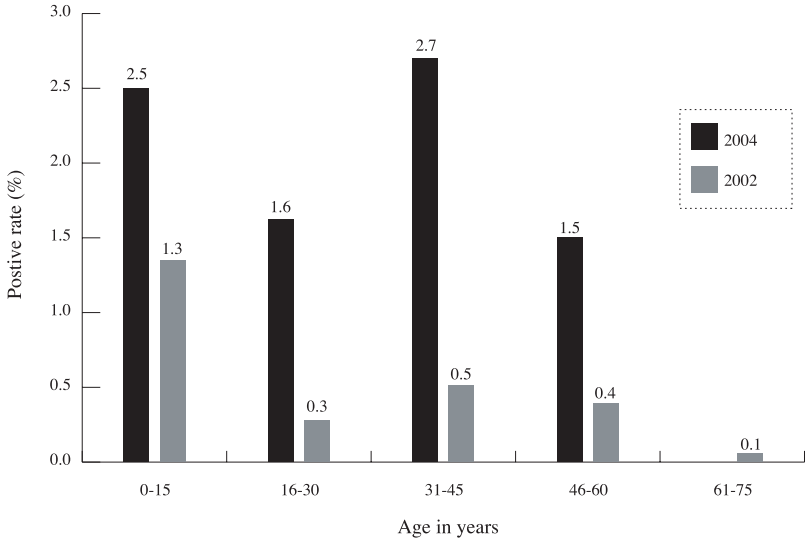

Fig 1- Prevalence of *Giardia lamblia* in different age-groups in Surin Province.

coli, *Endolimax nana* (9.8%), and *Blastocystis hominis* (5.9%) were also identified. Of the helminths, hookworm topped the list with an infection rate of 3.9%, follwed by the nematodes, *Enterobius vermicularis* (2%) and *Strongyloides stercoralis* (2%).

DISCUSSION

In this study, 2.9% of people were infected with *G. lamblia* with or without other intestinal parasites. This finding was similar to previous studies done in other parts of Thailand (Wilairatana *et al,* 1996; Waree *et al*, 2001; Waikagul *et al,* 2002; Saksirisampant *et al*, 2003; Sithithaworn *et al*, 2003) and other developing countries (Sinniah and Rajeswari, 1994; Gamboa *et al,* 1998; Minvielle *et al,* 2004).

Infection rate was lower (2.2%) in rural Surin and higher (6.5%) in Samut Sakhon, which is suburban. This finding was reasonable because the population of people studied in Samut Sakhon were all children whereas those from Surin were from various aged-groups.

The population in the suburban area in this report were only children aged between 5 to 7 years old. All of them were healthy and had no diarrheal symptoms at the time of stool collection and examination. Yet, *G. lamblia* infection was still detected. The significantly higher prevalence among children below 15 years appears to be associated with their behavior. Children usually practice less strict hygiene and engage in more play activities with soil. They are also prone to contaminated food and drink.

Although the use of various drugs to treat giardiasis has proven effective, there are still reports that

Table 4
Types of intestinal parasites detected in volunteers in Surin in 2004.

Types of parasites	No.	%
Protozoa	44	22.5
Giardia lamblia	27	13.8
Entamoeba coli	16	8.2
Trichomonas hominis	1	0.5
Helminths	152	77.5
Taenia	2	1.0
Opisthorchis	16	8.2
Strongyloides stercoralis	19	9.7
Hookworm	115	58.7
Total	196	100

Table 5
Types of intestinal parasites detected in schoolchildren in Samut Sakhon in 2003.

Types of parasites	No.	%
Protozoa	47	92.2
Giardia lamblia	20	39.2
Endolimax nana	5	9.8
Entamoeba coli	16	31.4
E. histolytica	3	5.9
Blastocystis hominis	3	5.9
Helminths	4	7.8
Enterobius vermicularis	1	2.0
Strongyloides stercoralis	1	2.0
Hookworm	2	3.9
Total	51	100

demonstrate failure to achieve complete cure, perhaps due to heavy infection or drug resistance (Upcroft and Upcroft, 1993). High frequency of infection has been reported in people with immunodeficiency or immune disorders (Manatsathit *et al,* 1996; Punpoowong *et al,* 1998). Weak humoral immunity may allow *Giardia lamblia* infection to persist in this group of people (Moolasart, 1999).

Other intestinal parasites were found in these studied populations, both in suburban (Samut Sakhon) and rural (Surin) areas. In Surin, helminth infection surpassed that of protozoa, with hookworm as the most significant type detected. On the other hand, intestinal protozoa were the substantial parasites found in Samut Sakhon, with a very low level of helminth infection. The overall rate of infection of intestinal parasites in Surin Province was significantly higher than Samut Sakhon Province, perhaps due to the location. Samut Sakhon is located nearer to Bangkok and is more developed than Surin, therefore the hygiene is assumed to be better. People who live in Surin are mostly farmers and agriculture workers, whose contact with soil and contaminated environment is assumed to be much more frequent than those who live in Samut Sakhon.

It was interesting to find that in more developed areas, the intestinal protozoa infections seemed to be more of a problem than helminths. This may be due to the more complex life cycle of helminths. Most helminths need to develop and change their stages outside the host before getting back into a new host as the infective stage. In suburban areas, helminths are not capable of completing their development outside the host and, thus, are not able to cause disease in a suburban population. On the other hand, the life cycle of the intestinal protozoa is simpler, with only 1 or 2 stages (trophozoite or cyst and trophozoite). The infective stage of the protozoa are smaller in size and tolerant to the harsh environment. This allows protozoa to survive in a more developed area and still cause health problems.

In general, people who live in rural areas are more prone to the ingestion of infective parasites whereas those who live in suburban areas are more likely to have better sanitation, hence possessing a lower chance of infection. The water supply in more developed areas is obviously cleaner, which reduces the chance of contamination. In rural areas, the nature of everyday activities brings people into close contact with natural sources of soil and water, therefore increasing the risk of ingestion as well as the penetration of infective stage parasites.

The significantly dominant protozoa in this study were *G. lamblia* and *E. coli*. Both possess the same transmission mechanism via the fecal-oral route. This indicates that education and more comprehensive programs are needed to ensure better personal hygiene and address this public health problem.

This study demonstrated that both rural and suburban areas in Thailand, are still having problems with various types of parasites both intestinal protozoa and helminths.

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