

Original article

Incidence of parasitic infections of in- and out-patients at Maharaj Nakorn Chiang Mai hospital, Chiang Mai University, Thailand 2012-2016

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Objective The objective of this study was to determine the incidence of parasitic infections in in- and out-patients at Maharaj Nakorn Chiang Mai Hospital, Chiang Mai University, Thailand during the period 2012 through 2016.

Methods Stool, blood, and sputum samples of patients were examined for parasite infections at the laboratory of the Department of Parasitology, Faculty of Medicine, Chiang Mai University. Stool samples were examined for intestinal parasites using the formalin-ether concentration technique, modified acid-fast staining, and simple smears. Stool and sputum samples were cultured for *Strongyloides stercoralis* using an agar plate technique. Blood samples were examined for malarial parasites using Giemsa staining of thick blood films.

Results During the five year study period, a total of 18,967 stool specimens were examined of which 1,268 (6.69%) were positive for at least one intestinal parasite. Helminthic infections were found in 6.02% of cases and 0.67% had protozoan infections. The most frequent helminth and protozoa among infected patients were *S. stercoralis* (58.60%) and *Giardia lamblia* (4.18%). The prevalence of malaria infection was 2.94%, with a higher positive rate for *Plasmodium vivax* (1.99%) than *P. falciparum* (0.95%). The annual incidence of intestinal parasites during the period 2012 through 2016 decreased significantly from 7.99% to 5.78%. Malaria infections between 2013 and 2016 also decreased from 3.23% to 1.76%, but the change was not statistically significant.

Conclusion There has been a decrease in the incidence of parasitic infections in patients presenting at the hospital over the study period. This may reflect improvement of the hygiene of people in northern Thailand in general. However, this information may not be representative of the parasitic infection situation of particular groups, e.g., hill tribe communities and other groups living in isolated rural areas.

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Introduction

Parasitic infections, including intestinal parasites as well as blood and tissue parasites, remain a major health problem in Thailand and other tropical countries. The incidence of parasitic

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infections, however, varies from one area to another depending on epidemiological factors, the level of personal and community hygiene, sanitation, hygienic habits, health education, and climatic factors (1-7). In recent years, intestinal parasitic infections have been reported to affect more than 35% of the Thai population (8-11). In the northeastern region, the liver fluke *Opisthorchis viverrini* was the most common parasite found in 29.30% of the population (12). In the northern region, previous surveys conducted at various times from 1969 to 1990 found prevalence rates of intestinal parasites ranging from 50.3% to 76.7% in Chiang Mai province (13,14). Intestinal helminthic infection rates, mainly nematodes, were as high as 48.9% in hill tribe schoolchildren in the northern region (15).

Malaria protozoa are the most important blood parasite infection in Thailand. In 2016, a total of 18,758 cases were reported, a rate of 0.29 cases/1000 population (16). The most common parasite was *Plasmodium vivax* (74.51%) followed by *P. falciparum* (16.23%). This differs from past studies where *P. falciparum* was detected more often than *P. vivax* (16, 17). Most the cases were found in people engaged in agriculture (36.52%). Other malaria parasites, *P. malariae*, *P. ovale*, and *P. knowlesi*, are very rare. In 2016, the highest incidence of malaria infection was in Yala province in the southern region. In the northern region, Tak, Mae Hong Son, and Chiang Rai provinces were highly endemic areas (17).

Maharaj Nakorn Chiang Mai Hospital, Chiang Mai University (CMU), Thailand is the largest hospital in the north. Over 3,500 patients, mostly from northern provinces, visit the hospital daily. Those suspected of parasitic infection are requested to be examined for the presence of parasites in their stool, sputum, or blood; the samples are routinely examined in the laboratory of Department of Parasitology, Faculty of Medicine, CMU. The results of those examinations are recorded in the hospital database system.

Objective

This study aimed to review the incidence of in-

testinal parasitic and malaria infection among in- and out-patients visiting Maharaj Nakorn Chiang Mai Hospital from 2012 through 2016 to increase understanding of the parasitic infection situation in the northern region of Thailand.

Methods

Stool and sputum samples collected during 2012-2016 and blood samples collected during 2013-2016 of in- and out-patients visiting Maharaj Nakorn Chiang Mai Hospital, Chiang Mai, Thailand were examined in the laboratory of the Department of Parasitology, Faculty of Medicine, CMU. Stool samples were routinely examined for intestinal parasites using the formalin-ether concentration technique and/or a simple smear (18). Modified acid-fast stain was used for diagnosis of intestinal coccidia protozoa, e.g. *Cryptosporidium* and *Microspora*. For detection of *S. stercoralis* in stool and sputum specimens, agar plate culture (19) in addition to the concentration method was performed. Malaria diagnosis was carried out by microscopic examination of thick blood films stained with Giemsa.

This study was approved by the Ethic Committee of the Faculty of Medicine (REC-25610503-13708). The identity and other personal information of the patients were not specified in data collection or presentation of this study. Results of parasite examinations were input into a computer using the Microsoft Excel and analyzed using descriptive statistics. The incidence of *S. stercoralis* which had been determined using different methods were compared using McNemar's test.

Results

Of 18,967 fecal specimens examined during 2012-2016, a total of 1,268 (6.69%) were positive for at least one intestinal parasite. Among the positive cases, the majority were helminthic infections (90%) and the rest protozoa infection (10%). Nineteen species of intestinal parasites were detected (Table 1). The most common parasites were nematodes (68.69%). The rest were trematodes (10.96%), cestodes (10.33%), and protozoa (10.02%). The most frequent helminth

Table 1. Incidence of 19 intestinal parasitic infections in in- and out-patients visiting Maharaj Nakorn Chiang Mai Hospital during 2012-2016 (1,268 infected cases out of 18,967 patients)

Parasite	Number of infected cases	Infection rate (%)
Nematodes		
<i>Strongyloides stercoralis</i>	743	58.60
Hookworm	54	4.26
<i>Ascaris lumbricoides</i>	46	3.63
<i>Trichuris trichiura</i>	24	1.89
<i>Capillaria philippinensis</i>	4	0.32
Trematodes		
<i>Opisthorchis viverrini</i> ¹	871	68.69
<i>Paragonimus heterotremus</i>	136	10.73
<i>Dicrocoelium dendriticum</i>	2	0.16
<i>Taenia</i> sp.	1	0.08
<i>Hymenolepis nana</i>	139	10.96
Cestodes		
<i>Giardia lamblia</i>	129	10.17
<i>Entamoeba coli</i>	2	0.16
<i>Endolimax nana</i>	131	10.33
<i>Entamoeba histolytica</i> ²	53	4.18
Protozoa		
<i>Blastocystis hominis</i>	38	3.00
<i>Isoospora belli</i>	13	1.03
<i>Trichomonas hominis</i>	7	0.55
<i>Cryptosporidium</i> sp.	7	0.55
<i>Microspora</i> sp.	4	0.32
	3	0.24
	1	0.08
	1	0.08
	127	10.02

¹Including eggs of small intestinal flukes which are indistinguishable from *O. viverrini*

²Including cysts/trophozoites of *Entamoeba dispar* which are indistinguishable from *E. histolytica*

was *S. stercoralis* (58.60%) followed by *Opisthorchis viverrini* (10.73%), *Taenia* sp. (10.17%), and hookworm (4.26%). The most common pathogenic protozoan was *Giardia lamblia* (4.18%). Single infection was common, accounting for 95.8% of cases (1,217 of 1,268), while the rates of double and triple infections were 3.86% (49) and 0.16% (2), respectively (Table 2). The most frequent double infection was *S. stercoralis*+*O. viverrini* (1.89%). Two cases were triple infection, *S. stercoralis* +*O. viverrini*+hookworm (0.08%), and *S. stercoralis* +*O. viverrini*+*G. lamblia* (0.08%). There was a decreasing trend in the annual positive rate for intestinal parasites from 2012 to 2016 (X^2 test for trend = 29.12, 1 d.f., $p < 0.0001$) (Figure 1).

Table 2. Double and triple infections of intestinal parasites

Parasites	%
<i>S. stercoralis</i> + <i>O. viverrini</i>	1.89
<i>A. lumbricoides</i> + <i>T. trichiura</i>	0.39
<i>S. stercoralis</i> +hookworm	0.32
<i>S. stercoralis</i> + <i>Taenia</i> sp.	0.32
<i>Taenia</i> sp.+ <i>O. viverrini</i>	0.24
<i>A. lumbricoides</i> + <i>G. lamblia</i>	0.16
<i>A. lumbricoides</i> + <i>E. histolytica</i>	0.16
<i>S. stercoralis</i> + <i>G. lamblia</i>	0.16
Hookworm+ <i>Taenia</i> sp.	0.08
Hookworm+ <i>T. trichiura</i>	0.08
Hookworm+ <i>E. histolytica</i>	0.08
<i>S. stercoralis</i> + <i>O. viverrini</i> +Hookworm	0.08
<i>S. stercoralis</i> + <i>O. viverrini</i> + <i>G. lamblia</i>	0.08

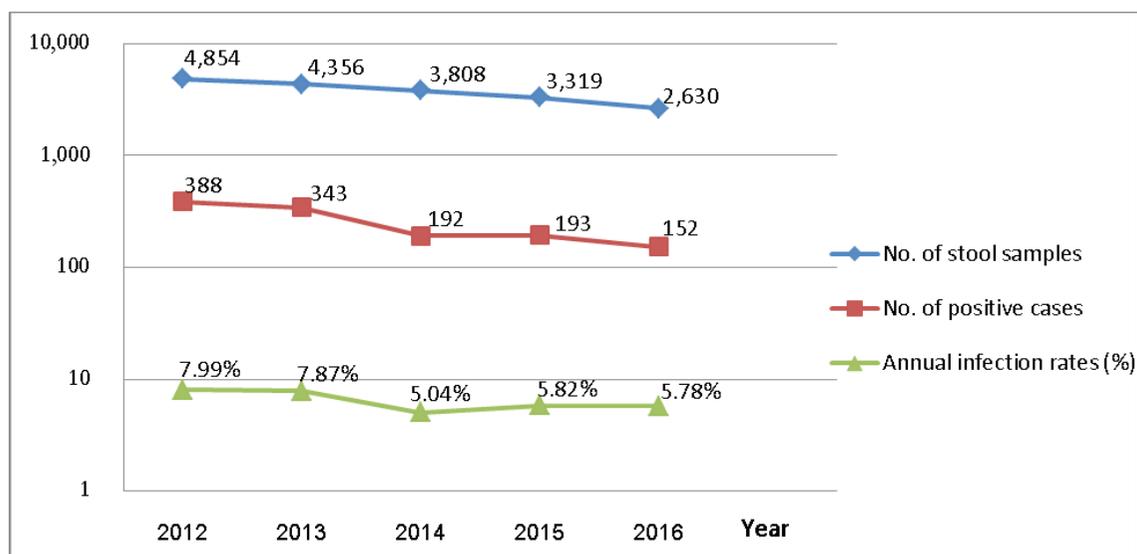


Figure 1. Annual infection rate of intestinal parasitic infection of patients visiting Maharaj Nakorn Chiang Mai Hospital during 2012-2016

Table 3. Comparison of stool concentration method, agar plate culture, and sputum culture for detection of *Strongyloides stercoralis* during 2012-2016 (740 samples)

Test procedure	Number infected	%
Stool concentration	7	0.94
Stool agar plate culture	29	3.92
Sputum direct smear	31	4.19
Total infected	67	9.05

A total of 740 fecal and sputum specimens from the same patients were examined for *S. stercoralis* infection using two different methods, agar plate culture and the stool concentration method, and the results were compared (Table 3). Sputum samples were examined using a direct smear. The agar plate culture gave a higher positive rate (3.92%) than the stool concentration method (0.94%) ($X^2 = 18.37$, 1 d.f., $p < 0.0001$) (Table 3). Similarly, the sputum direct smear gave a higher positive rate (4.19%) than the stool concentration method (0.94%) ($X^2 = 17.63$, 1 d.f., $p < 0.0001$). The positive rates of the sputum smear (4.19%) and the agar plate culture (3.92%) were not significantly different ($X^2 = 0.08$, d.f. 1, $p = 0.714$).

Thick blood film smears during the period 2013 through 2016 were examined for malaria parasites. The overall incidence of malaria infec-

tion was 2.94% (28/952). Two species of malaria parasites were found, *P. vivax* 1.99% (19/952) and *P. falciparum* 0.95% (9/952). The annual malaria positivity in 2013 was 3.23% which decreased to 1.76% in 2016, but this decline was not statistically significant (X^2 test for trend = 1.41, 1 d.f., $p = 0.2349$) (Figure 2).

Discussion

Intestinal parasitic infection is one of the neglected tropical diseases. Most infected individuals have mild or no symptoms. For that reason, patients who visit the hospital with gastrointestinal (GI) problems are checked for parasites in the GI tract, while patients visiting other clinics or wards are normally not checked. Therefore, the data in the present study did not cover all in- and out-patients of the hospital. Nevertheless, longitudinal data from 2012 through 2016 showed a decline in the number of specimens sent to our laboratory for parasitic diagnosis even though the total number of patients visiting the hospital actually increased by 7% over that period, according to Medical Records and Statistics Section. This may reflect a general the improvement in the hygiene of people in northern Thailand.

The most common parasite was *S. stercoralis* (58.60% of helminthic infections), followed by

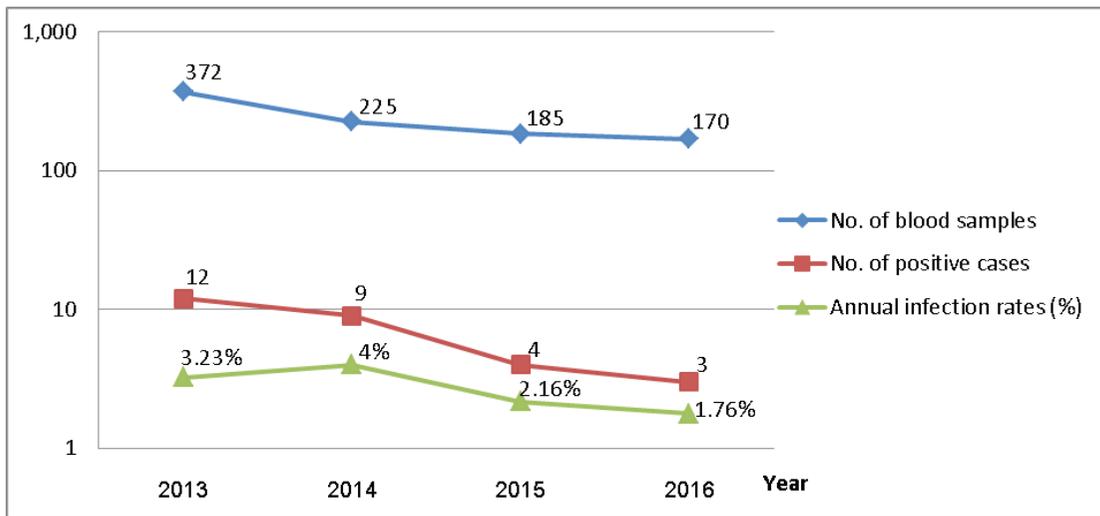


Figure 2. Annual infection rate of malaria infection in patients visiting Maharaj Nakorn Chiang Mai Hospital during 2013-2016

O. viverrini (10.73%) and *Taenia* sp. (10.17%). People normally get infected with *S. stercoralis* via skin penetration, particularly farmers engaging in agricultural activities. This parasite has autoinfection and can cause severe symptoms in immunocompromised patients. It has a high prevalence among HIV patients (4), but we did not have HIV data in this study. The highest prevalence of *O. viverrini* was in Udonthani province in the northeastern region with a rate of 8.7% (5). The incidence of *O. viverrini* in this study is considered to be overestimated because the eggs of this liver fluke are difficult to differentiate from those of small intestinal flukes. Recent studies (20,21) and ongoing observations by Office of Disease Prevention and Control No. 1 in Chiang Mai (Adulsak Wijit, personal communication) have revealed that *O. viverrini* is rare in northern region, and most of the eggs found in stools belong to *Haplorchis taichui*. Surveys of cyprinoid fish in Chiang Mai province also found that *H. taichui* metacercariae were the most common and those of *O. viverrini* were very rare (22). Using special staining or molecular techniques can provide more accurate infection rate information (23, 24). We were not able to differentiate morphologically the eggs of *Taenia saginata* and those of *T. solium*, but the former seemed to be more prevalent (25). Eating raw fish as well as raw meat

(beef and pork), a common practice of people in the northern region, is one likely source of infections.

Among hill tribe schoolchildren in Chiang Mai province, the prevalence of intestinal parasitic infection was 48.9%, with a high frequency of *G. lamblia* (14.9%) and hookworm (13.4%) (15). Recent surveys (2014-2016) of Karen schoolchildren in several hill tribe villages in Omkoi district, Chiang Mai province found a high prevalence of *A. lumbricoides* (approximately 50%) and *T. trichiura* (approximately 22%). The most common pathogenic protozoa infection was *G. lamblia* (approximately 10% of samples) (P. Somboon, unpublished data). In the central region, the protozoa infection rate was 4.24%, with a high prevalence of *G. lamblia* in school children (6).

Together, these studies indicate that intestinal parasitic infections are still a major public health problem in Thailand, but that infection rates may vary among population groups and regions. Those findings suggest that there is a need for improved environmental hygiene in affected communities in addition to existing health promotion programs and on-going infection control efforts (5-7).

The incidence of malaria detected in our laboratory has been decreasing in recent years which coincides with the reduction in the incidence of

malaria throughout Thailand (16, 17). The number of malaria cases has decreased by approximately 85% from 150,000 cases in 2000 to 22,038 cases in 2015 (16). In 2016, the number of malaria cases decreased by 34.2% from the previous year (16). The annual parasite incidence rate per 1,000 population decreased from 0.38 in 2015 to 0.25 in 2016 (16). That reduction is considered to be the result of the effective and on-going control program in Thailand. The Thailand National Malaria Elimination Strategy was established in 2016 with a goal of total elimination by 2024 (26). However, a big challenge remains in the forested border areas, particularly the Thai-Myanmar, Thai-Malaysia, and Thai-Cambodia borders where malaria remains highly endemic.

Conflicts of interest

None

Acknowledgements

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**อุบัติการณ์ของการติดเชื้อปรสิตในผู้ป่วยในและผู้ป่วยนอกที่เข้ามารับการรักษาที่
โรงพยาบาลมหาราชนครเชียงใหม่ มหาวิทยาลัยเชียงใหม่ ประเทศไทย
ในช่วงระยะเวลาปี พ.ศ. 2555 ถึง พ.ศ. 2559**

ผ่องศรี ทิพวงโกศล, อัจฉรียา จิตต์ภักดี, ดวงรัตน์ รียอง, สมศักดิ์ เปียงใจ, นิเวศน์ ไชยสวัสดิ์ และ
ปรัชญา สมบูรณ์
ภาควิชาปรสิตวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

วัตถุประสงค์ การศึกษานี้เป็นการศึกษาย้อนหลังเพื่อหาอุบัติการณ์ของการติดเชื้อปรสิตในผู้ป่วยในและผู้ป่วยนอกที่เข้ามารับการรักษาที่โรงพยาบาลมหาราชนครเชียงใหม่ มหาวิทยาลัยเชียงใหม่ ในช่วงระยะเวลาปี พ.ศ. 2555 ถึง พ.ศ. 2559

วิธีการ ตัวอย่างอุจจาระ เลือด และเสมหะของผู้ป่วยในและผู้ป่วยนอก ถูกส่งมาตรวจหาเชื้อปรสิตที่ภาควิชาปรสิตวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ การตรวจหาเชื้อปรสิตในลำไส้ในอุจจาระใช้วิธี formalin-ether concentration technique, การย้อมสีใช้วิธี modified acid-fast และการตรวจแบบ simple smear การตรวจหาหนอนพยาธิ *Strongyloides stercoralis* ในตัวอย่างอุจจาระและเสมหะใช้วิธีการเพาะเลี้ยงด้วยวิธี agar plate การตรวจหาเชื้อมาลาเรียในเลือดใช้วิธีการตรวจหาเชื้อในฟิล์มเลือดแบบหนาที่ย้อมด้วยสีกิมซ่า

ผลการศึกษา ในช่วงระยะเวลาที่ทบทวนผลการตรวจ มีจำนวนอุจจาระที่ได้รับการตรวจจากผู้ป่วยทั้งหมด 18,967 ราย พบปรสิตในลำไส้จำนวน 1,268 ราย คิดเป็นร้อยละ 6.69 ในกลุ่มที่มีการติดเชื้อปรสิตนี้มีผู้ที่ติดเชื้อหนอนพยาธิร้อยละ 6.02 และติดเชื้อโปรโตซัวร้อยละ 0.67 หนอนพยาธิที่พบมากที่สุดคือ หนอนพยาธิตัวกลมชนิด *S. stercoralis* และโปรโตซัวที่พบมากที่สุดคือ *Giardia lamblia* โดยพบการติดเชื้อร้อยละ 58.60 และ 4.18 ตามลำดับ อุบัติการณ์ของการติดเชื้อมาลาเรียพบร้อยละ 2.94 เป็นการติดเชื้อมาลาเรียชนิด *Plasmodium vivax* ร้อยละ 1.99 ซึ่งมากกว่าเชื้อมาลาเรียชนิด *P. falciparum* ที่พบมีการติดเชื้อเพียงร้อยละ 0.95 โดยรวมแล้วระหว่างปี พ.ศ. 2555 ถึง 2559 แนวโน้มของอุบัติการณ์การติดเชื้อปรสิตในลำไส้ลดลงอย่างมีนัยสำคัญจากร้อยละ 7.99 เป็น 5.78 การติดเชื้อมาลาเรียระหว่างปี พ.ศ. 2556-2559 ลดลงจากร้อยละ 3.23 เป็น 1.76 แต่ไม่แตกต่างกันทางสถิติ

สรุป อุบัติการณ์การติดเชื้อปรสิตในลำไส้ผู้ป่วยที่มารับรักษาที่โรงพยาบาลมีแนวโน้มลดลงในช่วงหลายปีที่ผ่านมา ซึ่งอาจสะท้อนว่าโดยทั่วไปประชาชนในภาคเหนือมีสุขอนามัยที่ดีขึ้น อย่างไรก็ตามข้อมูลนี้อาจไม่สะท้อนความเป็นจริงของการติดเชื้อปรสิตในบางกลุ่มเช่น ชาวเขาหรือประชาชนที่อาศัยในชนบทห่างไกล **เชียงใหม่เวชสาร 2562;58(2):69-76.**

คำสำคัญ: การติดเชื้อปรสิต โรงพยาบาลมหาราชนครเชียงใหม่