

# Prevalence of Parasitism among Students of the Karen Hill-Tribe in Mae Chame District, Chiang Mai Province, Thailand

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*Infection caused by intestinal parasites is still a common health problem in a poor-hygiene population especially for children in developing countries. A cross-sectional study was conducted among 781 Karen students (age: 3 to 19, males: 325, females: 456) to determine the current status of intestinal parasitic infections in a mountainous area in the North of Thailand. The study was drawn from three schools in the Doi Inthanon region, in Mae Chame district of Chiang Mai province, from December 2002 to June 2003. The techniques used for the diagnosis were: stool concentration by using the 'formalin-ether' technique and perianal region examination by using the 'Scotch-tape' technique. The average rate of intestinal parasites for the group tested using the stool concentration technique was 42.06% (male: 46.87%, females: 38.82%); and 22.66% (males: 28.92%, females: 18.20%) when using the Scotch-tape technique. Among helminth-infected individuals, enterobiasis was found at the highest prevalence (15.49%). Other common infections were ascariasis (9.78%), trichuriasis (5.90%) and hookworm infection (2.20%). Strongyloidiiasis was found only in 0.92%. For protozoa infection, the major cause is the non-pathogenic species "Entamoeba coli" (27.68%). The other non-pathogenic protozoa (Endolimax nana, Chilomastix meslini and Iodamoeba butschlii) had a low prevalence from ranged 0.18%-4.79%. The prevalence of pathogenic Giardia lamblia infection was 2.21%. Entamoeba histolytica infection was found in only one case. Based on the two techniques used, the results from the Scotch-tape provided a higher sensitivity for the detection of Taenia spp. and Enterobius vermicularis eggs. Drug treatment was given to all the infected students. School-based health education should be implemented in order to prevent and control the infections.*

**Keywords :** Parasitism, Karen hill-tribe student, Chiang Mai

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Parasitic infection is one of the obstacles to the development of the country and is considered as an economic loss <sup>(1)</sup>. The inter-annual report of the evaluation on the helminthiasis control program in Thailand by the end of the 8<sup>th</sup> health development plan in the year 2001 by division of general communicable diseases, Ministry of Public Health showed that more than 25 millions of the population in the countryside of Thailand are infected with parasites <sup>(2)</sup>. The rate of infection varied from area to area. However, from the last decade, the rate of infection in the northern part varied from 45.7%-60% <sup>(3-5)</sup>. The hilltribes which include Karen, Mong, Yao, Lee Saw, E-Goh, and Moo-Ser were supported through projects set up by the government and private sectors in terms of educational support, professional development, and improvement

of their health. The Karen tribe is the biggest group in Chiangmai province and reside in every highland include Doi Inthanon Peak (highest of Thailand, 2565.3341 meters above sea level). The public health burden of the intestinal parasites are substantial, particularly among children <sup>(6,7)</sup>.

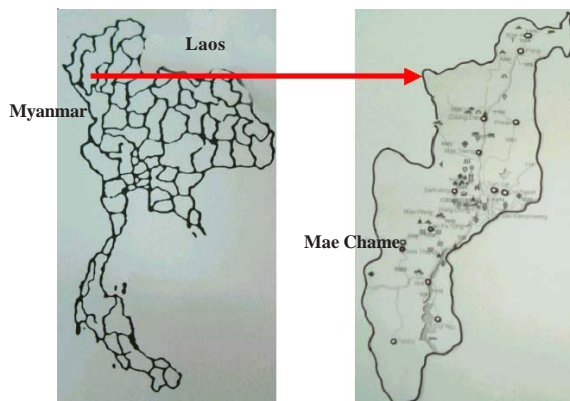
The purpose of this study was to find out the prevalence of the intestinal parasitic infection of students of the Karen hill-tribe in Chiang-Mai. The data derived from the study could be used for the epidemiological studies of the diseases and for the policy setting of the health-education issues in order to control and prevent various species of intestinal parasitic infections in the future.

## Material and Method

### Study area and population

The study area was the Doi Inthanon Peak in Mae Chame District (Fig. 1). It was performed from

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**Fig. 1** A map of Thailand; Chiang Mai Province and the survey point (Mae Chame district)

December 2002 to June 2003 (winter and summer seasons). The results are drawn from the students of these following three schools:

1. Sedosa School which is located in the Sedosa village. There are about 300 Karens and only 30 children who go to school. Her Royal Highness Princess Maha Chakri Sirindhorn provided her private funds for the establishment of the building in 2000.
2. Ratchaprachanukroh 31 School which was established in 1998 according to His Majesty the King's Projects in order to provide education for the hill-tribe children. There are about 700 students.
3. The Border Patrol Police School, Baan Mai Pattana Santi which was established in 1989 by the Border Patrol Police Bureau. There are 35 students.

#### Stool examinations

The technique used for the stool examination was the formalin-ether concentration technique<sup>(8)</sup>. A total of 542 stool specimens were collected (males: 220, females: 322). We, the authors found that stool samples from students under the age of 6 years old had an inadequate amount for the stool concentration technique. All specimens were fixed with formalin, then carried to the laboratory of the Department of Parasitology, Chulalongkorn University, Bangkok, Thailand for examination.

#### Scotch-tape technique

The technique used for the diagnosis of parasites at the perianal region was the Scotch-tape technique as described by Graham<sup>(9)</sup>. It was performed in the school's nurse room. 781 school children ranging in age from 3 to 19 years old (males: 325, females: 456) were recruited into this technique. Young children

participated readily, but the older ones were more difficult. So they had to be taught to perform by crouching in the toilet.

Each student was examined by both techniques. All were well informed about the purpose of the present study. Educational documents of parasites were distributed. At the end of the study, drugs treatment was given to all the infected students with the assistance of the doctors and the health officers of Mae Chame Local Health Centre.

#### Data analysis

All data were statistically analyzed and plotted using the Microsoft Program 'Excel 6.0'. The differences were analyzed by the unpaired student's t-test.

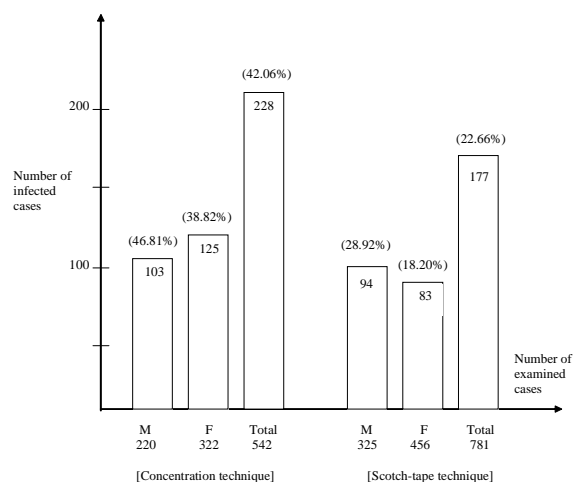
#### Results

According to the stool concentration technique, the average rate of the intestinal parasitic infections with helminths and protozoan among the students of the Karen hill-tribe in Mae Chame district, Chiang Mai province was 42.06%. The Scotch-tape technique provided 22.66%. From both techniques, no statistically significant differences were found between males and females ( $p > 0.05$ , Fig. 2).

#### Parasites detected from stool examination

##### Helminths

By the stool concentration technique, five species of roundworm were found in the stool specimens. The common ones were soil-transmitted helminthes: *Ascaris lumbricoides* (9.78%), *Trichuris trichiura* (5.90%),



**Fig. 2** Number of parasite infected cases in school children in Mae-Chame District, Chiang Mai Province, classified by gender and techniques

Hookworm (2.20%) and *Strongyloides stercoralis* (0.92%). The species which cause pruritis ani ; *E. vermicularis* had 0.18% (Table 1). Only one species of flat-worm: *Taenia* spp. (0.55%) was found. The younger children (aged 6-11 years old, Table1) tended to have a higher infection rate than the older children. The highest rate of *A. lumbricoides* and *T. trichiura* infections was significantly found in 6-8 years old children (p-value <0.05, Table 1).

#### Protozoa

Six species of protozoan were found, indicating the contamination of drinking water and poor hygiene among the children. The most common species was *Entamoeba coli* (27.60%). Other non-pathogenic species, listed according to their frequency of occurrence, were *Endolimax nana* (4.79%), *Chilomastix mesnili* (0.18%) and *Iodamoeba butschlii* (0.18%). Two pathogenic species found were *Giardia lamblia* (2.21%) and *Entamoeba histolytica* (0.18%, Table 1).

#### Parasites detected from peri-anal region examination Helminth

The prevalence of the two infections (enterobiasis and taeniasis) was highly detected by the Scotch-tape technique (15.49% and 5.25%). This technique provides higher sensitivity when compared to the stool concentration (41 cases compared to 3 cases of taeniasis, as well as 121 cases compared to 1 case of enterobiasis). The number of eggs found on these transparent tape varied from 1 to over 1,000. This data could confirm the most efficient means of Scotch-tape tech-

nique in the diagnosis of taeniasis and enterobiasis.

*Taenia* eggs may be found free in the feces if they break out of the gravid segment. In addition, they can also be recovered at the peri-anal region when the these segments pass the anus and the uteri branch is broken. The positive rate of taeniasis in this the present study was significantly five times higher when detected from Scotch-tape technique than those detected from the concentration technique (p-value < 0.001). As did the positive rate of enterobiasis which was significantly fifteen times higher (p-value < 0.001).

Other helminth eggs of *A. lumbricoides* and *T. trichiura*, even though they were principally found in the feces could also be amazingly detected at 2.94% and 0.38% on the peri-anal region. This indicates the poor hygiene especially in the children aged 3-5 years old (Table 2).

#### Discussion

To provide reliable data about the prevalence of the intestinal parasites, appropriate methods are required. The stool concentration technique is more sensitive in diagnosing intestinal parasites than the direct smear method <sup>(8,10)</sup>. However, it is not equally applicable to the detection of *Enterobius vermicularis* egg and *Taenia* spp. eggs that may not be highly found free in the feces. They were then recovered in this study by means of the Scotch- tape technique <sup>(9)</sup>.

The prevalence rate of intestinal parasitic infections varies from one area to another depending on the degree of personal and community hygiene, sanitation and climatic factors <sup>(11)</sup>. The specific data of

**Table 1.** Prevalence of intestinal parasitic infections of the Karen school children by stool concentration technique classified by age group

Parasites (number infected)	Age group (number examined)					Total (542)
	6-8(80)	9-11(190)	12-14(117)	15-17(119)	18-19(36)	
<b>Helminth</b>						
<i>A.lumbricoides</i>	14 (17.50%)	20(10.52%)	13(11.11%)	5(4.20 %)	1(2.77%)	53(9.78%)
<i>T. trichiura</i>	10(12.50%)	11(5.78%)	6(5.72%)	3(2.52%)	2(5.55%)	32(5.90%)
<i>Hookworm</i>	2(2.50%)	8(4.21%)	0	1(0.84%)	1(2.77%)	12(2.21%)
<i>E. vermicularis</i>	0	1(0.52%)	0	0	0	1(0.18%)
<i>S. stercoralis</i>	2(2.50%)	2(1.05%)	1(0.85%)	0	0	5(0.92%)
<i>Taenia</i> spp.	2(2.50%)	1(0.52%)	0	0	0	3(0.55%)
<b>Pathogenic protozoa</b>						
<i>G. lamblia</i>	3(3.75%)	6(3.15%)	3(2.56%)	0	0	12(2.21%)
<i>E. histolytica</i>	0	1(0.52%)	0	0	0	1(0.18%)
<b>Non-pathogenic protozoa</b>						
<i>E. coli</i>	24(30.00%)	59(31.05%)	34(29.05%)	26(21.84%)	7(19.44%)	150(27.67%)
<i>E. nana</i>	3(3.75%)	12(6.31%)	6(5.12%)	3(2.52%)	2(5.55%)	26(4.79%)
<i>C. meslini</i>	0	1(0.52%)	0	0	0	1(0.18%)
<i>I. butschlii</i>	1(1.25%)	0	0	0	0	1(0.18%)

**Table 2.** Prevalence of intestinal parasitic infections of the Karen school children by Scotch-tape technique classified by age group

Parasite (number infected)	Age group (number examined)						Total (781)
	3-5(17)	6-8(69)	9-11(234)	12-14(190)	5-17(202)	18-19(69)	
Helminth							
<i>A. lumbricoides</i>	3(17.64%)	4(5.79%)	7(2.99%)	8(4.21%)	1(0.49%)	0	23(2.94%)
<i>T. trichiura</i>	1(5.88%)	0	1(0.42%)	1(0.52%)	0	0	3(0.38%)
<i>E. vermicularis</i>	4(23.52%)	10(14.49%)	53(22.64%)	34(17.89%)	13(6.43%)	4(1.98%)	121(15.49%)
<i>Taenia</i> spp.	0	3(4.34%)	28(11.96%)	5(2.63%)	4(1.98%)	1(1.44%)	41(5.24%)
Protozoa				Not found			

the hill-tribes school children with parasitic infection in different districts of Chiang Mai province reported by Yamaguchi et al. in 1982 was 76.76% by the using cellophane thick smear technique<sup>(12)</sup>. A survey of Kasuya in 1989 by using the formalin ether sedimentation technique that was conducted in Muang district, Mae Rim district and Sarapee district revealed the average rate of intestinal parasite at 48.7%<sup>(3)</sup>.

Data from the present study still showed a high prevalence with the overall rate of 42.06% by the stool concentration technique. This was not much different from other reports in Chiang Mai. Compared to other provinces in the northern region, this rate was lower than the data collected from Phayao (60%) but equal to those from Chiang Rai (40%)<sup>(13,14)</sup>. However, the high rate of enterobiasis and taeniasis in the present study can confirm the efficiency of the Scotch-tape technique for the diagnosis of these two infections. This may be the cause of the uncommon observation of these two parasites in other surveys if the technique of Scotch-tape swab was not properly used.

*Taenia* spp: Taeniasis is very common in the North. The people are very fond of eating raw beef and pork, so-called, "Larb" and "Nahm". *Cysticercus bovis* and *cysticercus cellulosae* are also very commonly found in slaughter houses<sup>(12)</sup>. In an earlier investigation, taeniasis was much higher than in recent studies. In 1916, Kerr seems to be the first who surveyed the parasitic infection in northern Thailand and showed a positive rate of *Taenia saginata* at 58.3%<sup>(15)</sup>. The consequent rate of prevalence was 32% in 1953 and ranged from 1.1% to 4.0% from 1955-1982<sup>(12,16)</sup>.

*E. vermicularis* eggs which are generally deposited at night, and found scattered around the perianal region, should be practically detected in the morning before the patient washes or defecates. However, the rate of this infection investigated by stool examination had the lowest sensitivity and ranged from 7.0%-2.8% in the northern children<sup>(12)</sup>. The reinvestigation of this infection was studied in primary school

students in Chiang Mai in 1992 and found at the rate of 16.80% by using the Scotch-Scotch-tape technique<sup>(17)</sup>. In the present study, the authors found 15.49% of enterobiasis in Karen hill tribe school children. This was much lower than the recent studies of Tukaew et al in 2002 (45.38%)<sup>(18)</sup> who performed the Scotch-tape technique at people's house in the morning. The studies in school of many reports mostly investigated during daytime while the students were in school.

For *A. lumbricoides*, it was the most common soil-transmitted helminthes, (9.78%) in the present study. The prevalence of this parasitic infection in Chiang Mai population was rather high, ranging from 59% to 32% in the early reports during 1916-1969<sup>(13,15,16)</sup>. But, it was much lower in 1982 (0.30%) reported by Yamaguchi et al<sup>(12)</sup>. This was probably due to the mass treatment of intestinal helminthic infections with the local berries "Maklua" (*Diopyros mollis*) at that time<sup>(12)</sup>. The prevalence of ascariasis in Chiang Mai that were reconfirmed and investigated among school children in 1989 was 1.2%<sup>(2)</sup>. That might be the result of direct intervention of local, regional and international eradication projects, including improvement in sanitary conditions, a public health education campaign, the launching of the helminthiasis Control Project by the Ministry of Public Health.

However, the prevalence varies considerably with locality, behavioral factors, and sanitation. In the last national survey (September 2001) carried out by the department of Communicable Disease Control, Ministry of Public Health, it was shown that the overall prevalence of helminthes, determined by cellophane (Kato's) thick smear method was 22.3%<sup>(2)</sup>. The top two parasites were hookworm and *Opishorchis viverrini*. Classification by region for hookworm infection, it was 9.4% in the North, 9.2% in the Central region, 9.1% in the Northeast and 20.0% in the South of the country. The prevalence of hookworm infection from the present study was 2.2% which is much lower than the national survey of the north in 2001 (11.3%)<sup>(2)</sup>. The

authors investigated the foot-wear of the almost all the students under the regulation school uniform.

The data of protozoan infection have usually been a byproduct of survey for helminth which is normally performed by stool concentration or Kato's thick smear techniques. In the present study, the prevalence rate of *G. lamblia* (2.21%) was not different from the previous reports which ranged from 1.0% to 8.0%<sup>(3,5,12,19)</sup>. In general, the children are more frequently infected with *G. lamblia* than the adults especially those who live in an orphanages<sup>(10,20,21)</sup>. Although this flagellate formerly identified is now divided by enzyme patterns into *G. intestinalis* and *G. duodenalis* that can not be differentiated by microscopy<sup>(22,23)</sup>. The old names have been retained in the present study because it was concerned only with the microscopic examination. The other important protozoa pathogen: *E. histolytica* which appeared from the review in north Thailand was rather low, ranged from 0.9% to 6.3%<sup>(3,12)</sup>, as in the present survey (0.18% Table 1).

Judging by the rates of parasitic infection in many studies of school children, it seems that prevention and control measures should be implemented both in the schools and at the community level. Chemotherapy can effectively eliminate the parasites, however the improvements in sanitation by means of proper latrines should be continuously considered.

## Acknowledgements

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## ความชุกของปรสิตในนักเรียน ชาวเขา เผ่ากระเหรี่ยงในอำเภอแม่แจ่ม จังหวัดเชียงใหม่ประเทศไทย

วิไล ศักดิ์ศิริสัมพันธ์, จารุรัตน์ เกานิบล, เพ็ญจิตร์ กาพนณี, สุนิดา ไทยสม, สุทิน เย็นท่าข้าม, สุรางค์ นุชประยูร

โรคติดเชื้อปรสิตในลำไส้ยังเป็นปัญหาของประชากรสุชนน่ายไม่ดี โดยเฉพาะเด็กในประเทศกำลังพัฒนา ได้ศึกษาจากเด็กนักเรียนชาวกระเหรี่ยง 781 ราย (อายุ 3-19 ปี, ชาย 325 ราย, หญิง 456 ราย) โดยศึกษาจากโรงเรียนสามแห่งในบริเวณดอยอินทนนท์ ในอำเภอแม่แจ่ม จังหวัดเชียงใหม่ ระหว่างเดือนธันวาคม 2002 ถึงมิถุนายน 2003 เพื่อตรวจภาวะการติดเชื้อปรสิตในลำไส้ ใช้เทคนิคการตรวจจุลจากระบบเข้มขึ้นด้วยฟอร์มาลิน อีเทอร์ และตรวจรอบทวารด้วยวิธีสกอต-เทป พบอัตราเฉลี่ยของการติดเชื้อปรสิตในลำไส้โดยวิธีตรวจจุลจากระ 42.06% (ชาย 46.87%, หญิง 38.82%) และโดยวิธีสกอต-เทป พบ 22.66% (ชาย 28.92%, หญิง 18.20%) จากกลุ่มผู้ติดเชื้อเหล่านี้พบโรคหนอนพยาธิชนิด Enterobiasis สูงสุด (15.49%) ส่วนชนิดอื่นคือ Ascariasis (9.78%) Trichuriasis (5.90%) และ Hookworm (2.20%) โรคติดเชื้อ Strongyloidiasis มีเพียง 0.92% ส่วนเชื้อโปรโตซัวนั้น ที่พบมากที่สุดคือ โปรโตซัวชนิดไม่นำโรค "Entamoeba coli" (27.68%) และชนิดอื่น ๆ (Endolimax nana, Chilomastix meslini และ Iodamoeba butschlii) มีความชุกต่ำ 0.18%-4.79% ส่วนความชุกของชนิดนำโรค Giardia lamblia มี 2.21% เชื้อ Entamoeba histolytica มีเพียงรายเดียว จากเทคนิคการตรวจทั้งสองวิธี สกอต-เทปให้ความไวต่อการตรวจหาไข่ Taenia spp. และ Enterobius vermicularis มาก ได้ให้ยารักษาแก่นักเรียนที่ติดเชื้อทุกคน การให้สุขศึกษาเป็นวิธีหนึ่งเพื่อป้องกันและควบคุมการติดเชื้อ