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## Eosinophilia with low prevalence of parasitism in a rural area of Maha Sarakham Province after annual mass treatment with mebendazole and albendazole

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**Background** : *Human intestinal parasites affect both children and adults in Maha Sarakham Province. Annual mass treatment with mebendazole or albendazole has been performed in this area since 1981. As part of a program to promote public health development in a remote rural area, we provided health education as well as stool examination and complete blood count in order to assess the basic health status in a population in a rural area of Maha Sarakham Province.*

**Objective** : *To assess the prevalence of intestinal parasites and anemia in a rural population in Maha Sarakham Province of Thailand, after a long-term mass treatment with mebendazole and albendazole.*

**Setting** : *Kog-soong , Nong-seaw , Na-seaw, and Nong-khee Subdistricts, Vapeepatum District, Maha Sarakham Province.*

**Design** : *Descriptive study*

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**Subjects** : One hundred and ninety individuals with ages ranging from 2 to 76 years (mean  $\pm$  SD = 39  $\pm$  19.2; Median = 42) were recruited for this study. There were 87 (45.79 %) males and 103 (54.21 %) females. There were 41 (21.57 %) individuals were under 15 years old.

**Methods** : As part of the Community Development Program of the Faculty of Medicine, Chulalongkorn University, stool examination was performed by the formalin-ether concentration technique. CBC was performed by using a Technicon H\*3 automated electronic cell counter.

**Results** : Human intestinal parasitic infections were found in 13 (6.84 %) individuals. The parasites most commonly identified were hookworm (5 cases; 38.46 %) and *Giardia lamblia* (3 cases; 23.07 %). Other parasitic infections were *Taenia sp.* and *Echinostoma sp.* (2 cases each; 15.38 %), and *Opisthorchis viverrini* (1 case; 7.69 %). A non-pathogenic protozoan, *Endolimax nana*, was found in one case. The majority of the infected individuals were over 15 years old (10 cases; 76.92 %). Anemia and eosinophilia were found in 38.60 % and 14.04 % of population, respectively.

**Conclusions** : Parasitic infections were present in a low prevalence in this rural population of Northeastern Thailand. The results suggested that health education and mass treatment help decrease infections caused by common parasites. However, the high prevalence of anemia and eosinophilia deserve further investigation.

**Key words** : Parasites, Complete blood count (CBC), Thailand, Rural, Anemia, Eosinophilia.

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**ที่มาของปัญหา** : มีการตรวจพบปรสิตในลำไส้ของเด็กและผู้ใหญ่ ซึ่งอาศัยในจังหวัดมหาสารคาม ซึ่งประชากรได้รับยารักษาพยาธิแก่ทั้งชุมชนทุกปี ตั้งแต่ พ.ศ. 2524 โครงการค่ายปลายปี คณะแพทยศาสตร์จุฬาลงกรณ์มหาวิทยาลัย ได้มีการให้สุขศึกษาแก่ชุมชนชนบทในเขตวาปีปทุม จังหวัดมหาสารคาม พร้อมกับตรวจอุจจาระและตรวจเลือด เพื่อประเมินสุขภาพของประชากรในชุมชนนี้

**วัตถุประสงค์** : เพื่อประเมินอัตราความชุกของปรสิตในลำไส้และภาวะซีดในชุมชนหนึ่งของจังหวัดมหาสารคาม ภายหลังจากชุมชนได้รับยารักษาพยาธิ mebendazole และ albendazole ทุกปี

**สถานที่ทำการวิจัย** : ต.โคกสูง ต.หนองเสียว ต.นาเสียว และต.หนองฮี อ.วาปีปทุม จ.มหาสารคาม

**รูปแบบการวิจัย** : การศึกษาเชิงพรรณนา

**ผู้เข้าร่วมการวิจัย** : ผู้เข้าร่วมการศึกษา 190 ราย อายุตั้งแต่ 2 ถึง 76 ปี (mean  $\pm$  SD. = 39  $\pm$  19.2; ค่า median = 42) เป็นชาย 87 (45.79 %) ราย หญิง 103 (54.21 %) ราย โดยเด็กทั้งหมด 41(21.57 %) ราย

**วิธีการวิจัย** : ทำการตรวจอุจจาระโดยวิธีเข้มข้น (formalin - ether) และตรวจเลือดโดยเครื่องตรวจอัตโนมัติ (Technicon H\*3)

**ผลการวิจัย** : พบปรสิตในลำไส้ในผู้ป่วย 13 (6.84 %) ราย โดยปรสิตที่พบมากที่สุดคือพยาธิปากขอ (5 ราย; 38.46 %) และเชื้อ Giardia lamblia (3 ราย; 23.07 %): สำหรับปรสิตอื่นที่พบคือ พยาธิตัวตืด: Taenia sp. และ Echinostoma sp. (ชนิดละ 2 ราย ;15.38 %) พยาธิใบไม้: Opisthorchis viverrini (1 ราย; 7.69 %) พบโปรโตซัว Endolimax nana 1 ราย ผู้ติดเชื้อปรสิตส่วนมากเป็นผู้ใหญ่ (10 ราย; 76.92 %) ภาวะซีดและฮีโมโกลินฟีเลียพบ 38.60 % และ 14.04 % ตามลำดับ

**สรุป** : การติดเชื้อทางปรสิตพบน้อยมากในชุมชนนี้ ผลที่ได้ชี้ให้เห็นว่าการให้สุขศึกษาและการให้ยารักษาพยาธิแก่ชุมชนทุกปี ทำให้อัตราการตรวจพบปรสิตน้อยลง อย่างไรก็ตามภาวะซีดและฮีโมโกลินฟีเลียในชุมชนนี้ควรได้รับการวินิจฉัยถึงสาเหตุต่อไป

People in rural areas of Thailand have difficulty accessing good health care and basic health education. Subsequently, some preventable diseases such as parasitic infections are still prevalent in many remote areas of Thailand.<sup>(1-4)</sup> The Faculty of Medicine of Chulalongkorn University is aware of these public health problems and the institute has set up the Community Development Program to encourage medical students to learn how to solve public health problems in rural areas. The program objectives are to help medical students understand real-life health care management, and techniques for communicating with local people. Furthermore, these medical students also learn thinking and working processes as in order to solve the local public health problems appropriately. During the program, the medical students provide health education and help villagers in other aspects (e.g. help build latrines) as well.

This study was a part of the Community Development Program "Public Health Project" organized by the Medical Student Council of the Faculty of Medicine of Chulalongkorn University as a part of the "End of the Year Camp" for 30 medical students. The project was performed at Vapeepatum District, Maha Sarakham Province during March 14 -29, 1998. The main aims of this program were to provide medical students 1) experience in working as a team; 2) to learn how to establish good relations with villagers; 3) to realize local public health problems; and 4) to scientifically solve public health problems. This report is the results of study of parasitic diseases. Stool examination and CBC were performed as indicators of the basic health status of the people in this rural area.

## Materials and Methods

### Study area and participants:

One hundred and ninety individuals living in Kog-soong, Nong-seaw, Na-seaw, and Nong-khee Subdistricts, Vapeepatum District, Maha Sarakham Province, were recruited into the study. In cooperation with local health workers, we dealt directly with the community leaders who assisted us in maximizing community participation and compliance. The people in this area were willing to participate in the study. All individuals found to have illness were referred to Vapeepatum District Hospital for appropriate treatment. Verbal informed consent was obtained from each individual and child's parent or guardian.

### Stool examinations:

Stool specimens were obtained from all participants and examined for the presence of intestinal parasite eggs or larvae as previously described.<sup>(1,3)</sup> About ten grams of each stool specimen were collected. Stool examination was performed microscopically using a direct smear technique at the camp by medical students. The rest of samples were fixed in formalin before further processed by using a formalin-ether concentration technique, and then examined under microscope at the Department of Parasitology, Faculty of Medicine, Chulalongkorn University.

### Complete blood counts (CBC)

Venous blood samples were drawn and sent to King Chulalongkorn Memorial Hospital for CBC determination. The CBC was performed using a

Technicon H\*3 automated electronic cell counter, as previously described.<sup>(3)</sup> Hemoglobin (Hb) was measured in grams per deciliter (g/dl), red blood cell count in cells per microliter, and mean cell volume (MCV) in femtoliters (fl), while hematocrit (Hct) and mean red cell hemoglobin concentrations (MCHC) were calculated from the Hb, MCV, and red blood cell count of each individual. White blood cell count and platelet count were reported in the same fashion. Differential counts were confirmed by visual examination of blood smears. Absolute neutrophil count and absolute eosinophil count were calculated from the differential count and white blood cell count from each individual.

#### Data analysis

All data were statistically analysed by the Microsoft Excel 6.0 programs.

#### Results

##### Characteristics of study population

Cartons were provided to 205 individuals residing in Kog-soong, Nong-seaw, Na-seaw, and Nong-khee Subdistricts, at the time of our visit. There were 190 (93 %) individuals who returned their stool samples the next day. Of the 190 individuals examined for intestinal parasites, 41 (21.57 %) were children under 15 years old (29 boys and 12 girls) and 149 (78.42 %) were adults (58 males and 91 females) (Table 1.) The ages of these individuals ranged from 2 to 76 years for males with the mean  $\pm$  SD of  $36.02 \pm 21.1$  (median = 41). The females ages ranged from 4 to 80 years with the mean  $\pm$  SD of  $41.45 \pm 17.1$  (median = 44).

##### Parasitism in the studied population

Intestinal parasites were recovered in 13 (6.84 %) individuals (Table 1). The most common organisms were hookworm (5 persons; 38.46 %) and *Giardia lamblia* (3 persons; 23.07 %) while *Echinostoma*, *Taenia* and *Opisthorchis viverrini* were found at 15.38 % (2 cases), 15.38 % (2 cases) and 7.69 % (1 case), respectively (Table 1.). Only one non-pathogenic organism, *Endolimax nana* was found in one individual (data not shown).

Out of the 13 infected individuals, 3 cases were school-age children (1 infected with hookworm, 2 with *Giardia lamblia*), and 10 cases were adults (7 female and 3 male) (Table 1). Among female adults, 3 individuals were infected with hookworm, one each with *Giardia lamblia*, and *Echinostoma*, and two with *Taenia*. The 3 adult males were infected with hookworm, *Echinostoma* and *Opisthorchis viverrini*, respectively. Interestingly, no mix of parasitic infections was identified in these individuals.

##### Complete blood count

Venous blood was drawn from 67 adults and we could analyze 57 (93.44 %) of the blood samples, 17 from male and 40 from female. The remaining 4 samples were clotted and, therefore, discarded. The detailed data of the CBC is shown in Table 2.

##### High prevalence of eosinophilia and anemia

Eosinophilia was found in 8 individuals (14.04 %) (6 female, 2 male) while 38.60 % (22 cases) of the studied population had anemia (15 female, 7 male) (Table 3). Seven cases of anemic individuals had MCV below 80 fl, while the rest had  $\geq$  80 fl. Only 2 anemic cases had eosinophilia among those who

provided blood for CBC, and 3 individuals who provided both stool and blood samples for examination. All of these persons had normal CBC values. Therefore, we could not correlate the results from CBC

with parasitism. However, our previous data showed that eosinophilia is common in rural populations and hookworm infections are significantly associated with eosinophilia, but not to anemia. <sup>(3)</sup>

Table 1. Frequency of parasitic infections in various age groups.

Age group (Years)	Number examined	Number infected with Hookworm	Number infected with <i>Giardia lamblia</i>	Number infected with <i>Teania</i> sp.	Number infected with <i>Echinostoma</i> sp.	Number infected with <i>Opisthorchis</i> sp.	Total infected number (%)
≤ 15	41	1	2	0	0	0	3 (23.07)
> 15 - 30	21	0	0	0	0	0	0 (0.00)
> 30 - 45	43	1	1	1	2	1	6 (46.15)
> 45 - 60	63	2	0	0	0	0	2 (15.39)
> 60	22	1	0	1	0	0	2 (15.39)
Total	190	5	3	2	2	1	13 (100.00)

Table 2. The complete blood count values of adults.

Sex	Male	Female
Number of subjects	17	40
Red cell count (X10 <sup>6</sup> /μl)	4.9 ± 0.62	4.6 ± 0.1
Hemoglobin (g/dl)	14.4 ± 0.4	12.2 ± 0.3
Hematocrit (percent)	46.4 ± 2.6	39.5 ± 0.6
Mean red cell volume (fl)	93.2 ± 2.4	86.3 ± 1.5
Mean red cell hemoglobin Concentration (g/dl)	32.0 ± 0.3	30.8 ± 0.3
Mean red cell hemoglobin (pg)	29.8 ± 0.7	26.6 ± 0.6
Red cell distribution width (%)	14.8 ± 0.3	15.4 ± 0.3
Platelet count (X10 <sup>6</sup> /μl)	230.0 ± 13.5	270.5 ± 9.4
White blood cell count (X10 <sup>3</sup> /μl)	3.9 ± 0.3	4.0 ± 0.2
Neutrophil (%)	30.2 ± 3.5	33.6 ± 2.0
Lymphocyte (%)	42.8 ± 2.3	43.9 ± 1.8
Monocyte (%)	9.0 ± 0.9	7.2 ± 0.3
Eosinophil (%)	14.9 ± 1.9	12.4 ± 1.3
Absolute eosinophil count (/μl)	574.0 ± 76.8	534.6 ± 79.2
Basophil (%)	5.4 ± 0.6	4.4 ± 0.4

Table 3. Anemia of the examined adults; AEO = Absolute Eosinophil Count.

MCV	Number	Hemoglobin (g/dl)				Total	
		Male		Female		Anemia	Normal
		Anemia ( < 14)	Normal ( ≥ 14)	Anemia ( < 12)	Normal ( ≥ 12)		
< 80	7	1	0	6	0	7	0
≤ 80	50	6	10	9	25	15	35
<b>Total</b>	<b>57</b>	<b>7</b>	<b>10</b>	<b>15</b>	<b>25</b>	<b>22</b>	<b>35</b>
AEO >1000	8	1	1	1	5	2	6
AEO ≤1000	49	6	9	14	20	20	29
<b>Total</b>	<b>57</b>	<b>7</b>	<b>10</b>	<b>15</b>	<b>25</b>	<b>22</b>	<b>35</b>

### Discussion

Parasitic infections affect people in most developing countries worldwide. For Thailand, parasitic helminths affect more than 35 % of The population.<sup>(4)</sup> Hookworm infection are found at the highest rates followed by liver fluke infections.<sup>(4)</sup> The prevalence rates of intestinal parasitic infections vary from one area to another depending on the degree of personal and community hygiene, sanitation and climatic factors.<sup>(5)</sup>

As part of the Community Development Program, 30 medical students from the Faculty of Medicine of Chulalongkorn University participated in the Public Health Program. In other to assess the general health status of a population in Maha Sarakham Province, we performed stool examinations and CBC. The formalin-ether concentration technique was used to diagnose intestinal helminths since it was more sensitive than the direct smear method.<sup>(1-3,5)</sup> We found that only 6.84 % of the studied population harbored parasites. This number was 5 times less than the national average (35 %) according to the national epidemiological survey of 1996.<sup>(4)</sup> The people

of Vapeepatum District have been well educated concerning hazards from infectious agents and how to prevent common parasitic disease. The annual visits and treatments with mebendazole between 1981 - 1992, and albendazole since 1981 for common parasitic infections and change risky health behaviors help decrease the prevalence of parasitic diseases.<sup>(6)</sup> In comparison, remote areas of Tak and Khon Kaen Provinces<sup>(1,2)</sup> have 46 % and 34 % of their populations carrying at least one parasite, respectively. Obviously, the health intervention program significantly helps control common parasitic disease.

We found that anemia and eosinophilia are still common in this population even though the prevalence of parasitism has started to decrease. One third of the anemic population had mild microcytic anemia, which could be from iron deficiency or Thalassemia trait, mild anemia with MCV > 80 fl could be due to hemoglobin E trait and which is common in northeastern Thai populations. Further investigation is needed to address the prevalence of iron deficiency.

Eosinophilia is most likely associated with parasitism. However,<sup>(4)</sup> it is unknown how long



eosinophilia persists after eradication of the parasitic infection. In this study, other potential causes of eosinophilia such as allergy has not been investigated. Due to small sample sizes of CBC and stool specimens association, between intestinal parasites and eosinophilia could not be assessed.

Parasitic diseases are still diseases of the poor though the diagnosis and treatment for most of them are not difficult. The common consequences of parasitic infections have been shown to affect nutritional status,<sup>(7-9)</sup> physical development, mental function, verbal ability and inhibition-control aspects of cognitive behavior in children.<sup>(10-12)</sup> However, the morbidity from parasitic infections is mild but chronic. Therefore, the significant impact of parasitism on public health is mostly ignored by people. Previous studies have shown that parasitic diseases are still public health problem.<sup>(1-3)</sup> The data from this study suggests that annual health education and treatment is an effective strategy to control most parasitic infections.

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