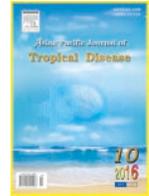




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## Prevalence and factors of head lice infestation among primary school students in Northern Thailand

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## ABSTRACT

**Objective:** To survey the prevalence of head lice infestation among primary school students in Chiang Rai Province, Northern Thailand from November 2015 to February 2016 and to investigate factors involving these infestations.

**Methods:** A total of 703 students were checked for head lice infestations. The data were analyzed by using descriptive statistics *i.e.* frequencies, percentages and correlations [odds ratio (OR) and 95% confidence interval (CI)].

**Results:** The overall percentage of head lice infestations was 15.1%. No infestation was found in boy students. The prevalence of head lice infestation was significantly associated with itching on a scalp (OR = 5.206, 95% CI = 3.116–8.696), having dirty fingernails (OR = 2.019, 95% CI = 1.217–3.352), wearing dirty clothes (OR = 4.532, 95% CI = 1.651–12.438), having history of head lice infestations (OR = 3.998, 95% CI = 2.174–7.356) and family member having history of head lice infestations (OR = 1.997, 95% CI = 1.092–3.651).

**Conclusions:** Pediculosis capitis is still public health problem in this region. Effective treatment is required to control this infestation in urgent.

## 1. Introduction

Pediculosis capitis or commonly known as head lice infestation is an infestation of *Pediculus humanus capitis*. It is a disease that causes apparent morbidity among school children worldwide[1]. Transmission is significantly found in overcrowded community due to highly frequent direct contact and re-infestation after successful treatment is also common. It is endemic globally including developed and developing countries located in tropical and temperate areas[2]. Schoolchildren are the most sensitive to the infestation rather than the other groups of population[3-5]. Average prevalence of pediculosis capitis in Asia was 15.1% ± 12.8%[1]. In Thailand, head lice infestation was also frequently found among primary schoolchildren. The 2010 report showed

high head lice infestation rate of 84.30%–88.40%) among primary schoolchildren in Ratchaburi Province near Thai-Myanmar border[6]. The 2012 report showed head lice infestation rate of 23.3% among school children in Bangkok[7]. Chiang Rai Province posits in the northernmost point of Thailand with the borders connecting to by Myanmar and Laos. It is also a home of many ethnic groups who immigrate into this province for habitation and occupation. Pediculosis capitis is also one of the important public health problems of this area. To control this problem, surveillance of head lice infestation should be done continuously. Therefore, this study aims to investigate prevalence and factors involving with head lice infestation among primary school students in Chiang Rai Province. The findings from this study may be useful for preparing control strategy to improve the public health conditions of primary school students in this area.

## 2. Materials and methods

## 2.1. Research design

A cross-sectional survey was administered from November

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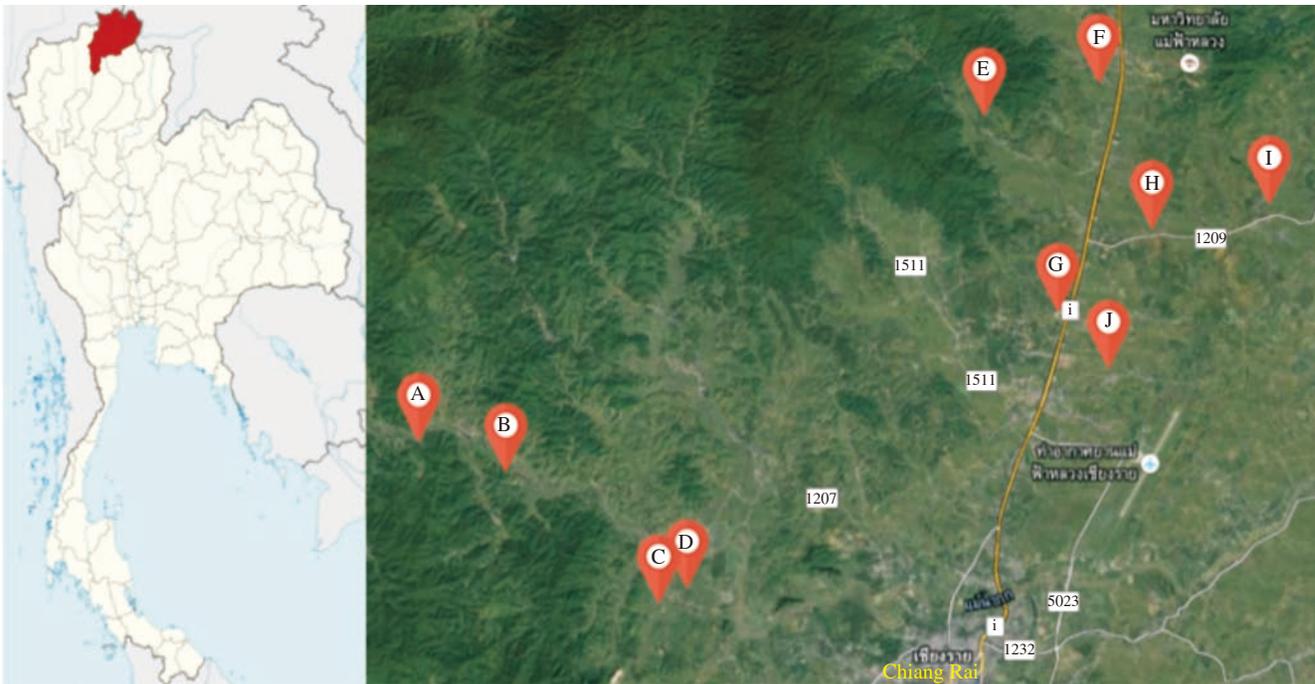
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The study protocol was performed according to the Helsinki Declaration and approved by the Ethical Review Committee of Chiang Rai Rajabhat University (ETH. CRRU 001/58). The legal guardians of all participants provided informed written consent.

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**Figure 1.** Locations of studied areas.

Left: Map of Thailand indicating Chiang Rai Province; Right: Locations of 10 schools in Chiang Rai Province where were recruited in this study (source: Google map). A: 19°57'29.7" N, 99°41'31.4" E; B: 19°56'54.4" N, 99°43'20.9" E; C: 19°55'17.1" N, 99°45'44.2" E; D: 19°55'28.2" N, 99°45'58.8" E; E: 20°01'40.3" N, 99°50'48.5" E; F: 20°01'58.8" N, 99°52'26.2" E; G: 19°59'49.8" N, 99°51'54.3" E; H: 20°00'13.3" N, 99°52'13.9" E; I: 20°00'26.4" N, 99°53'00.2" E; J: 19°59'00.1" N, 99°52'42.9" E.

2015 to February 2016 among 10 primary schools in Chiang Rai Province as shown in Figure 1. The research was reviewed and all examinations were carried out under permission of the teachers or the children's parents. A questionnaire was issued to the participants to collect socio-demographic data related to age, gender and factors that associated with head lice infestations.

## 2.2. Examination

The well-trained examiners checked the infestation status by visually scanning the students' heads by using a fine-toothed comb at three key areas of the head: frontal, temporal behind ears and occipital. The students were also observed for personal hygiene, type and length of hair, and the presence of skin diseases.

The students were marked positive for head lice infestation if any evidence of head lice was noticed such as detection of head lice adult or nymph and active or dead eggs[8]. No infestation was noted when the scalp was clear from any stage of lice.

## 2.3. Data analysis

Prevalence of head lice infestation was stratified according to socio-demographic characteristics. Descriptive statistics were used for the analysis of demographic data and prevalence of infestations. The odds ratio (OR) was used for determining the correlation between different groups and factors that associated

with head lice infestation.

## 2.4. Ethics

The study protocol was performed according to the Helsinki Declaration and approved by the Ethical Review Committee of Chiang Rai Rajabhat University (ETH.CRRU 001/58). The legal guardians of all participants provided informed written consent.

## 3. Results

### 3.1. Socio-demographic characteristics

The socio-demographic information of student was shown in Table 1. A total of 703 students (378 boy students and 325 girl students) from 10 schools were recruited. They were 6 to 16 years old. The majority of the participants was children who lived with parents. About 28.2% of all participants had 4 people in their family. Almost of all participants (74.5%) was non-ethnic group and 59% of parents were general employees.

### 3.2. Prevalence of head lice infestations

The prevalence of head lice infestations was shown in Table 1. The overall prevalence in this study was 15.1% and was found to be more prevalent in girls (32.6%) than in boys (0.0%). The socio-demographic characteristics that were found to be related to the

highest prevalence of infestation included 1) age of 10 years old (22.0%), 2) education of Grade 5 students (22.5%), 3) living with friend (50.0%), 4) numbers of family member more than 5 (16.4%), 5) parents were employees (18.6%) and 6) ethnic group (18.4%).

**Table 1**

Prevalence of head lice infections in 703 primary schoolchildren in Chiang Rai Province, Thailand.

Variables	Head lice infection			
	Number of infestation/total	%	P value	
Owner of school	Governmental	97/610	15.9	0.075
	Private	9/93	9.7	
Gender	Male	0/378	0.0	0.000
	Female	106/325	32.6	
Age (years)	6	2/24	8.3	0.013
	7	11/111	9.9	
	8	18/123	14.6	
	9	24/114	21.1	
	10	28/127	22.0	
	11	16/91	17.6	
	12	6/77	7.8	
	13	0/21	0.0	
	> 13	1/15	0.7	
Education level	Grade 1	14/120	11.7	0.017
	Grade 2	17/129	13.2	
	Grade 3	17/117	14.5	
	Grade 4	27/131	20.6	
	Grade 5	24/108	22.2	
	Grade 6	7/98	7.1	
	Parents	87/558	15.6	0.408
	Relative	16/122	13.1	
	Friend	1/2	50.0	
	Other (dormitory, temple)	2/21	9.5	
Number of family member	2	4/28	14.3	0.926
	3	21/157	13.4	
	4	32/198	16.2	
	5	21/149	14.1	
	> 5	28/171	16.4	
Career of parent	Agriculturist	21/151	13.9	0.007
	General employee	77/415	18.6	
	Seller	1/43	2.3	
	Officer	0/31	0.0	
	Company employee	3/33	9.1	
	Other (self-employed business)	4/30	13.3	
Ethnic	Yes	33/179	18.4	0.930
	No	73/524	13.9	
Overall		106/703	15.1	

### 3.3. Factors involving with head lice infestations

Association between head lice infestations with personal characteristic for these infestations in 325 girl students was shown in Tables 2. The prevalence of head lice infestations was highly associated with itching on scalp [OR = 5.206, 95% confidence interval (CI) = 3.116–8.696], having dirty fingernails (OR = 2.019, 95% CI = 1.217–3.352), and wearing dirty clothes (OR = 4.532, 95% CI = 1.651–12.438)] (Table 2). In contrast, prevalence of the infestations was not associated with hair length

more than 10 cm, curly hair, having wound on scalp, having a long fingernail and having a dirty body (Table 2).

**Table 2**

Person characteristic correlated with head lice infections in 325 girl students in Chiang Rai Province, Thailand.

Risk characteristics		Examined cases	Infected cases	OR	95% CI
Hair length > 10 cm	Yes	275	86	0.683	0.367–1.270
	No	50	20		
Curly hair	Yes	53	22	1.588	0.868–2.905
	No	272	84		
Wound on scalp	Yes	9	5	2.661	0.700–10.120
	No	316	101		
Itching on scalp	Yes	97	57	5.206	3.116–8.696
	No	228	49		
Dirty fingernails	Yes	88	39	2.019	1.217–3.352
	No	237	67		
Long fingernails	Yes	64	27	1.681	0.959–2.949
	No	261	79		
Dirty body	Yes	13	7	2.510	0.822–7.664
	No	312	99		
Wearing dirty clothes	Yes	18	12	4.532	1.651–12.438
	No	307	94		

Association between head lice infestations and possible factors for these infestations in 325 girls was shown in Table 3. Prevalence of head lice infestation correlated significantly with having history of head lice infestations (OR = 3.998, 95% CI = 2.174–7.356) and family member having history of head lice infestations (OR = 1.997, 95% CI = 1.092–3.651). In contrast, prevalence of the infestations was not associated with unwashed hair/body daily, washed hair by herself, uncut nail weekly, sharing mattress and blanket, using utensils with other people, and uncleaned mattresses and pillow case weekly (Table 3).

**Table 3**

Correlation of risk factors with head lice infections in 325 girl student in Chiang Rai Province, Thailand.

Risk factors		Examined cases	Infected cases	OR	95% CI
Unwashed hair daily	Yes	137	34	0.532	0.327–0.865
	No	188	72		
Washed hair by herself	Yes	291	98	1.650	0.720–3.780
	No	34	8		
Unwashed body daily	Yes	12	4	1.034	0.304–3.515
	No	313	102		
Uncut nail weekly	Yes	126	43	1.118	0.696–1.797
	No	199	63		
Sharing mattress and blanket	Yes	252	78	0.720	0.419–1.239
	No	73	28		
Having history of head lice infestation	Yes	223	91	3.998*	2.174–7.356
	No	102	15		
Family member had history of head lice infection	Yes	52	24	1.997*	1.092–3.651
	No	273	82		
Using utensils with other people	Yes	108	36	1.050	0.643–1.716
	No	217	70		
Uncleaned mattress and pillow case weekly	Yes	219	70	0.913	0.558–1.494
	No	106	36		

## 4. Discussion

The 15.1% infestation rate found in this study indicated that

head lice were considered a vital public health problem among schoolchildren, especially, girl students in Chiang Rai Province. Nevertheless, the prevalence found in this study was lower than those in the previous studies in which the prevalence varied from 36.6% to 88.4%[6-7]. The variation of prevalence in the same country can be observed from the difference in examination technique, sample group, study area, criteria for infestation and season. Prevalence of lice infestation reported in this study was similar to the average prevalence in Asia while higher than that of Europe and less than that of South America[1]. The previous prevalence reported from some parts of the world were also different. For example, infestation rates among schoolchildren in Chile, Egypt, Turkey, and Iran were 40.3%, 16.7%, 13.5% and 7.4, respectively[9-12]. An epidemic infestation rate, defined by the national pediculosis association of USA, was more than 5%[13].

This study showed that girl students were a risk group of lice infestation which was similar to the previous studies from many countries[14-17]. Different behaviors between boys and girls might lead an effect to transmission rates and susceptibility of head lice infestation[18]. The previous studies indicated that head-to-head contact and the passive transference such as sharing hair accessories, brushes, hats, and combs were important routes of transmission which was in contrast with the results from this study[19]. Interestingly, boy students were not found lice infestation in this study. The findings in this study may result from the regulations for the public school in Thailand that all boy students must have hair style. This hair style might be inappropriate habitat for lice and may be a good solution to reduce head lice transmission in boy students.

The infestation rate may also change through the age groups of primary school children. Some reports showed incremental rate in the risk of infestation by 15% for every year of age[20]. This study found that the highest prevalence level was found in Grade 5 (22.2%). Likewise, pediculosis prevalence rates were also higher in children aged 10 to 12 years in Brazil[21]. Young age (15 years old) was the most important risk factor for pediculosis capitis in Peru[22].

The itching of a head in girl students was associated with head lice infestation. Itching, the most common symptom of lice infestation, is resulted from an allergic reaction against saliva of lice and depends on a person's sensitivity and sanitary conditions[23]. Therefore, itching on scalp is the good sign for detection of lice infestation. In contrast, others build up tolerance to the bites and have little or no itching, even with repeated infestations[24].

Moreover, girl students having a dirty fingernails and wearing dirty clothes are significantly associated with head lice

infestation. Long fingernails can harbor more infectious organism including nits of lice than short ones. Therefore, fingernails should be kept short and the undersides should be cleaned properly with soap and water. In addition, sharing dirty clothes is another way to spread of lice. To reduce risk of infestation, clothes must be cleaned properly before wearing. However, the previous study demonstrated that household size of > 4 persons, low quality of house construction material and presence of animals in the household were significantly associated with pediculosis capitis in Peru[22].

Re-infestation in students and family members was also commonly found in this study. Therefore, all members of the house and the others in close contact should be checked and receive treatment[5,25]. Treatment should be prescribed when active lice or viable nits are noticed[24]. The treatment should aim at killing the lice and the ova. The fight against pediculosis is certainly a very ancient concern and various methods have been used to get rid of it[24]. Pediculicides are considered the most effective treatment for pediculosis capitis[24-26]. Agents with long residual effect seem to be ovicidal[27]. However, noncompliance, improper application of pediculicides, or re-infestation, and the resistance of lice to pediculicides are the common roots of treatment failures[27]. None of the currently available topical pediculicides works 100% as ovicidal, and resistance to all of them has been observed. For effective treatment and reducing the development of insecticide resistance in lice, insecticide susceptibility should be done against samples of lice population to determine effective concentration before applying insecticide to people in the community.

In conclusion, head lice infestation is considered a community management problem and the community needs more public knowledge in this regard. Public training is the best solution in preventing the epidemic of pediculosis in the community, so people are informed and equipped with prevention and treatment of lice infestation within the family and community. Therefore, educational campaigns and planning of management strategy are urgently needed to address this issue by national and regional health authorities.

### Conflict of interest statement

We declare that we have no conflict of interest.

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