ORIGINAL ARTICLE

Prevalence and predictors of pediculosis capitis among primary school children in Hulu Langat, Selangor

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ABSTRACT

Introduction: Pediculosis capitis infestation is endemic in both developing and developed countries leading to various physical, economical and psychological consequences. Our main objective was to determine the prevalence and predictors of pediculosis capitis among primary school children in Hulu Langat District, Malaysia.

Methods: An analytic cross-sectional study using cluster random sampling method was carried out in Hulu Langat District, Malaysia. Self-administered pretested questionnaires were used to collect the data. Hair and scalp examination was also carried out. Multivariate logistic regression was used to control for potential confounding and determine the predictors.

Results: The overall mean age of the 1,336 respondents was 9.3 years. Majority were males (52.8%), Malays (79.5%) and 81.3% of the fathers had secondary or tertiary education as compared to 77.3% for the mothers. The overall prevalence of pediculosis capitis was 15.3%. The prevalence of pediculosis was significantly higher among females (28.4%) than males (3.7%, p=0.001). Multivariate logistic regression analysis showed that age 10 years or more (Odds Ratio (OR) = 2.34, 95% Confidence Interval (CI) = 1.673 to 3.272), female gender (OR = 10.26, 95% CI = 6.620 to 15.903), history of contact with an infested person (OR = 2.11, 95% CI = 1.506 to 2.960), Indian compared to Chinese (OR = 3.55, 95% CI = 1.282 to 9.860), Malay to Chinese (OR = 2.59, 95% CI = .994 to 6.774) were associated with pediculosis capitis.

Conclusions: Prevalence of pediculosis capitis among children aged 7 - 12 years in Hulu Langat District was high. There is a need for screening and treatment of pediculosis capitis in primary schools.

KEY WORDS:
Prevalence, predictors, pediculosis capitis, primary school, Hulu Langat

INTRODUCTION

Society has evolved tremendously with time, inventing various technologies and making quantum leaps. Nonetheless, the world is not freed from many other common health problems. Although this may be a true problem that has existed in the past, it is still tremendously of high prevalence today. One such problem is pediculosis capitis (head lice), which is perceived to be community problem Pediculosis capitis is endemic in both developing and developed countries. It is a common infestation in school children and 12 to 24 million school days are lost annually.[1] The United States Centers for Disease Control and Prevention (CDC) reports an estimated six to 12 million infestations occur each year among children 3 to 11 years of age in the United States.[2] In Korea, the overall prevalence of head lice was 4.1%, 23.32% in Bangkok, Thailand, 9.1% in Lima, Peru and 4.7% in Iran.[3-6] Meanwhile, in Australia, the prevalence in schoolchildren was 13%, with a range between schools of 0% to 28%.[7] The prevalence of pediculosis capitis in Brazil was 43% in a slum and 28% in a fishing village.[8] In Jordan, the prevalence was significantly higher among girls (34.7%) compared to boys (19.6%), children with longer hair and those aged 6-8years.[9]

The prevalence of pediculosis capitis in Malaysia was found to be high. A survey of 308,101 primary school children in Peninsular Malaysia conducted in 1979 by the School Health Services, Ministry of Health, Malaysia, revealed that 10.7% of children were infested with Pediculus humanus capitis.[10] In this study, the highest incidence of pediculosis was seen in Indians (26.6%) followed by Malays (19.6%), and Chinese (2%). A cross-sectional study in 2004 among 463 eleven-year-old primary schoolchildren in Kuala Krai, Kelantan, found the prevalence of head lice infestation was even higher at 35.0% (95% CI: 30.6 to 39.3) with 11.9% inactive, 23.1% active, 18.2% light and 16.8% heavy infestations. The associated factors were girls; family income of RM247 or less; head lice infestation among family member, and having four or more siblings.[11]

The infestation problem may lead to various physical, economical and psychological consequences. Pruritus is the most common symptom of a lice infestation and can cause disturbance of sleep at night due to intense scratching.[12] Bite reactions, excoriations, secondary impetiginisation, pyoderma, cervical lymphadenopathy, conjunctivitis, fever, and malaise are also possible manifestations.[13] Pediculus humanus capitis infestation can also cause substantial social distress, discomfort, parental anxiety, embarrassment to the child, and unnecessary absence from school and work.[14] A negative social stigma frequently accompanies the identification of pediculosis as well as the frustration involved with the cost, time and effort needed for treatment and

environmental control.[15] Head lice distribution might be affected by the age, sex, socio-economic status, hair length, urban-rural location, family size, crowding in homes and classrooms, degree of infestation of other family members, and sharing of comb.[16-18]

The objective of this study was to determine the prevalence and predictors of pediculosis capitis among government primary school children in Hulu Langat, Selangor.

MATERIALS AND METHODS

This was an analytical cross-sectional study, which was conducted at government primary schools in Hulu Langat District, Selangor, Malaysia. Data were collected among all the eligible students (n = 1,336) from Standard One to Five between 1 March and 20 April 2015.

Sample size calculation was done assuming a confidence level and interval of 95% and 0.05, respectively, with power of 90%. Based on this, 780 was the calculated required sample size after 20% allowance for non-respondents. The sampling process was carried out in two phases. In phase I, the schools were selected using table of random numbers from the list of 87 government primary schools in Hulu Langat district. Selection of the classes was carried out in phase II using the list of all the classes in primary one to six from the selected schools. All students from the selected classes with consent from their parents or caregivers to participate in this study were eligible to be included. Children who were attending special education classes or were absent from school on the day of data collection were excluded from the study.

Questionnaires used in this study comprised of questions covering socio-demographic data and the associated factors of having pediculosis capitis. The questionnaires were available in Malay, English, Tamil and Mandarin versions. A pilot study was conducted among primary school children in Sepang district. Feedback from respondents upon using the questionnaires was obtained and necessary amendments were made before the questionnaire was finalised. During data collection, the questionnaires were distributed and answered at the point of interview.

Data collection
There was a total of 14,354 students from the 18 selected schools. Out of those 1,352 students were eligible to be included in this study, however, only 1,336 students responded fully to the questionnaires and underwent the necessary hair and scalp examination. All the students in the selected classes were given the respondent's information sheet and parent/guardian consent form prior to data collection. Then, the students were given the self-administered questionnaire according to their preferred language, to be completed. When students were not able to read, especially the standard one and two students, the class teacher and the researcher would help them individually to complete the questionnaires.

Subsequently, the hair and scalp of each student were examined for head lice or eggs by the researcher. The hair

was combed using a fine-toothed plastic comb for one minute. During combing, the artefacts were transferred onto a clean sheet of A4 white paper. Magnifying glass was used to provide better examination of the lice and nits. The time taken to perform the examination was approximately three minutes per child. A case is defined positive for pediculosis when one or more adult lice are found; or one or more nits are found on the hair shaft of the human host. The results of the examination were recorded in a table prepared beforehand. Other information which was obtained from the questionnaire was recorded as well. The students who were found to have pediculosis were given a referral letter to the nearest health care facility for treatment.

The identification of a live louse, nymph, or a viable nit on the head is by far the gold standard for diagnosing head lice. Visual inspection without combing is difficult since head lice avoid light and crawl quickly.[14] The diagnosis of lice infestation using a lice comb is fourfold more efficient than a direct visual examination.[19] In this study, the examination was done by using direct visual inspection followed by combing of the hair using lice comb. Therefore, it has substantially increased the effectiveness of diagnosing pediculosis capitis infestation among the children who were involved in this study.

Statistical analysis
The Statistical Package for Social Sciences Software (SPSS) Version 22 was used for data analysis. Descriptive statistics was conducted to obtain mean, frequency and percentage of variables. Inferential analysis was done using chi-square (for categorical data) to determine the association between variables at a level of significance, $p<0.05$. Variables with p-value less than 0.25 were selected for multivariate logistic regression analysis to determine the predictors of pediculosis capitis (categorical dependent variable), while the confounders were controlled. The results were expressed as odds ratio (OR) with 95% Confidence Interval (CI). A two-sided p-value less than 0.05 was considered as statistically significant. Analysis was also done to obtain the value of Nagelkerke R Square, assessment of the goodness of fit, Hosmer-Lemeshow Test, and classification table. Multicollinearity was checked for intercorrelations among the predictors.

Ethical issues
All respondents gave informed consent to participate in the study. The study protocol was approved by the institutional review boards of Universiti Putra Malaysia, Ministry of Education, Malaysia and State and District Education Department. Approval from the principals of the schools was obtained prior to carrying out the study.

RESULTS

During this study, 18 primary schools were selected with 1,352 students were eligible to involve in this study. However, only 1,336 students responded fully to the questionnaires and undergone the necessary hair and scalp examination. The response rate was 98.8%. Non-respondents were those who were absent from school on the day of data collection and did not consent to be examined. Pediculosis capitis were found in

Table I: Prevalence and association of pediculosis capitis with socio-demographic characteristics

Socio-demographic characteristics	Positive for pediculosis capitis [n (%)]		χ^2	df	p-value
	No	Yes			
School location					
Rural	565 (84.2)	106 (15.8)	0.213	1	0.644
Urban	566 (85.1)	99 (14.9)			
Age					
7 - 9 years	625 (89.0)	77 (11.0)	21.804	1	< 0.001*
10 - 12 years	506 (79.8)	128 (20.2)			
Gender					
Male	680 (96.3)	26 (3.7)	156.7	1	< 0.001*
Female	451 (71.6)	179 (28.4)			
Ethnicity					
Malay	901 (84.8)	161 (15.2)	11.29	3	0.010*
Chinese	84 (94.4)	5 (5.6)			
Indian	141 (78.8)	38 (21.2)			
Others	5 (83.3)	1 (16.7)			
Father's education level					
No Formal Education / Primary education	207 (82.8)	43 (17.2)	2.429	2	0.297
Secondary education	406 (83.5)	80 (16.5)			
College / University	518 (86.3)	82 (13.7)			
Mother's Education					
No Formal Education / Primary education	261(86.1)	42 (13.9)	1.683	2	0.431
Secondary education	464 (85.3)	80 (14.7)			
College / University	406 (83.0)	83 (17.0)			

Note : Chi square test ; * Significant p<0.05

Table II: Prevalence and association of pediculosis capitis with other associated factors

Factors	Positive for pediculosis capitis [n (%)]		χ^2	df	p-value
	No	Yes			
Number of siblings					
1	72 (86.7)	11 (13.3)	4.551	5	0.473
2	268 (87.0)	40 (13.0)			
3	292 (84.6)	53 (15.4)			
4	250 (85.0)	44 (15.0)			
5	147 (80.3)	36 (19.7)			
More than 5	102 (82.9)	21 (17.1)			
Number of Family members					
2	32 (97.0)	1 (3.0)	4.850	3	0.183
3	55 (87.3)	8 (12.7)			
4	219 (85.5)	37 (14.5)			
More than 4	825 (83.8)	159 (16.2)			
Hair type					
Straight	964 (85.1)	169 (14.9)	1.052	1	0.305
Curly	167 (82.3)	36 (17.7)			
Hair length					
At hairline (short hair)	776 (68.6)	89 (43.4)	48.272	1	<0.001*
Long hair	355 (31.4)	116 (56.6)			
Frequency of hair washing					
Less than once a week	82 (86.3)	13 (13.7)	2.970	3	0.396
Once a week	242 (87.7)	34 (12.3)			
Twice a week	359 (83.9)	69 (16.1)			
Thrice or more a week	448 (83.4)	89 (16.6)			
Contact with infested person					
Yes	371 (75.3)	122 (24.7)	53.171	1	0.001*
No	760 (90.2)	83 (9.8)			
Level of cleanliness					
Clean	671 (85.8)	111 (14.2)	2.302	2	0.316
Moderate	450 (83.2)	91 (16.8)			
Dirty	10 (76.9)	3 (23.1)			
Comb sharing					
Yes	687 (82.8)	143 (17.2)	5.992	1	0.014*
No	444 (87.7)	62 (12.3)			

Note: Chi square test ; * Significant p<0.05 ; a p-value calculated using Fisher's Exact Test

Table III: Simple logistic regression showing crude odd ratio (OR) of predictors of pediculosis

Factors	Crude OR	95% CI	p-value
Age			
7 – 9 years	1.00		<0.001*
10 – 12 years	2.053	1.512 – 2.788	
Gender			
Male	1.00		<0.001*
Female	11.339	7.350 – 17.494	
Ethnicity			
Chinese	1.00		0.039*
Malay	3.293	1.276 – 8.496	
Indian	4.385	1.597 – 12.042	
Others	4.069	0.322 – 51.375	
Hair Length			
At hairline (short)	1.00		0.813
Long	2.849	1.361-2.947	
Comb Sharing			
No	1.00		0.072*
Yes	1.382	0.971 – 1.966	
Contact with someone infested			
No	1.00		<0.001*
Yes	2.111	1.505 – 2.961	

* Significant p-value <0.25

Table IV: Multivariate analysis showing the predictors of having pediculosis capitis

Factors	B	SE	Wald	df	p-value	Adjusted OR	95% CI Lower	95% CI Upper
Gender								
Male						1.00		
Female	2.326	0.224	108.46	1	<0.001*	10.260	6.620	15.90
Age								
7 - 9 years						1.00		
10 – 12 years	0.850	0.171	24.665	1	<0.001*	2.340	1.673	3.272
Ethnicity								
Chinese						1.00		
Malay	0.953	0.490	3.790	1	0.052	2.594	0.994	6.774
Indian	1.268	0.520	5.938	1	0.015	3.555	1.282	9.860
Others	1.020	1.328	0.590	1	0.443	2.773	0.205	37.466
Contact with someone infested								
No						1.00		
Yes	0.747	0.172	18.811	1	<0.001*	2.112	1.506	2.960

Note: CI = confidence interval; OR= odds ratio, Overall classification, 84.7%; Hosmer and Lemeshow Test, p=0.676; Nagelkerke R Square, 0.279; * Significant p-value <0.005.

205 students (15.3%). The respondents were divided into age group of 7-9 and 10-12 years. The overall mean age was 9.3 years (Standard Deviation (SD) = 1.482) with 52.5% were from age group of 7-9 years and 47.5% were from age group 10-12 years. The socio-demographic characteristics of the respondents were described in Table I. The prevalence of pediculosis capitis is associated with age (χ^2 = 21.804, df = 1, p<0.001), gender (χ^2 = 156.7, df = 1, p<0.001) and ethnicity (χ^2 = 11.29, df = 3, p=0.010).

Table II shows the prevalence and the association of pediculosis capitis with other risk factors. The prevalence of pediculosis capitis was directly associated with history of previous contact with someone infested with pediculosis (χ^2 =53.171, df = 2, P<0.001) and practice of comb sharing (χ^2 =5.992, df = 1, P=0.014).

The prevalence of pediculosis capitis was also associated with the length of hair (χ^2 = 48.272, df = 1, p<0.001) in which the students with long hair had higher prevalence of pediculosis capitis (24.6%) as compared to those with short hair (10.3%).

A simple logistic regression was done to determine the crude odds ratio as shown in Table III and all the variables that had P value <0.25 were entered into the multivariate analysis. All the independent variables that were significantly associated with pediculosis capitis from the Chi square analysis were included in this analysis (Age group, gender, ethnicity, hair length, history of contact with infested person and comb sharing).

Table IV shows the multivariate analysis for predictors of having pediculosis capitis. The odds of developing pediculosis is two times higher among the students aged 10-12 years old (OR = 2.340, 95% CI = 1.673 to 3.272) as compared to those aged 7-9 years old. Female had a ten-fold likelihood to develop pediculosis (OR = 10.260, 95% CI = 6.620 to 15.903). The odds of developing pediculosis is three times higher in

Indians (OR = 3.555, 95% CI = 1.282 to 9.860). Those who had a history of contact with an infested person increased the likelihood of developing pediculosis capitis two times higher than those who never had any contact with an infested person (OR = 2.105, 95% CI= 1.506 to 2.960).

DISCUSSION

An overall infestation rate of 15.3% was found in this study. Previous studies in Malaysia reported the prevalence ranging from 10.7% to 35.0%.[10,11] This shows that pediculosis capitis is still a major public health problem among the school-aged children in Hulu Langat District. Several studies have reported higher prevalence among the younger age group which possibly attributed to the close contact between children as they develop more social relationships following the first years in school.[10,13,17]

Many studies have reported higher prevalence of pediculosis in females.[5,7,13,16-18] In this study, the prevalence of head lice infestation in females was significantly higher than in males across all school grades. The cause of this gender-specific prevalence may have been attributed to gender related behaviour, such as females being likely to have closer and more prolonged social contact in small groups than males, and the tendency of females to have long hair.[10,17,20] The infestation rate was significantly higher in children with long hair than in children with short hair.[1] Bathing with longer hairs could be difficult for children and it can also cause difficulty in inspection for infestation by parents and health officers. Besides, longer hair harbours heavier head lice infestation.

The number of household signify the level of closeness and crowdedness. Living in a household with more than four persons is a significant risk factor for pediculosis capitis as crowdedness hastens the spread of pediculosis.[5] A study done in Malaysia reported a significant association of pediculosis prevalence among students who have at least one family member infested with pediculosis.[10] The spread of pediculosis is most commonly by close person-to-person contact as lice are incapable of jumping or flying.[23]

Parents' education and occupation could be assumed as the representatives of their socio-economic level. The prevalence is higher among low socio-economic status and rural populations.[6,11,18] Demographical results showed that there was a significant decrease in children's infestation with increasing father's and mother's education as educated parents have more information about head lice due to their knowledge obtained through reading and social communication.[6] In contrary, extreme poverty is closely related to overcrowded dwellings, poor hygiene, poor attitude of less concern about head lice infestation, poor knowledge about transmission and less accessibility to health care. Even though it is usually associated with the lower income group, none of the other income groups is spared. Head louse infestation is not limited to uneducated or poor strata.[24] This could be contributed by the fact that children from the higher economic strata are still exposed to the transmission when they are in schools. Apart from that, many of the working parents leave their children in the nursery or day care facilities during daytime. The risk of transmission is high in

these facilities as the children are closely in contact with each other, for a longer duration of time, almost every day of the week. Head-to-head contact is the most important factors in transmission of head lice infestation through sharing of infested instruments including combs, hats, scarves and common pillows.[6,21,22]

Some of the literature have suggested that there is no significant association between head lice infestation and poor hygiene.[11,17,19] Head lice transmission through head-to-head contact can easily occur despite the persons are hygienic. The result of higher prevalence of pediculosis among those who had more frequent hair washing could be contributed by the presence of intense itchiness due to the infestation. Thus, they tend to wash their hair more frequently. Responses to queries on personal hygiene can be misleading because interviewed children are reluctant to admit inappropriate practices. They could also tend to avoid stigma that could have been exerted upon them if they were found not to practice proper hygiene.

In battling pediculosis capitis infestation, there is a need for educational campaigns, regular mass screening and treatment, and planning a management strategy. Holistic behavioural and social intervention programs should be implemented in the primary schools which include increase awareness on hygiene, identifying factors associated with pediculosis capitis and early detection of infestation. Health educational programs for the students, family and teachers should be carried out. School health programs should involve trained professionals to increase the effectiveness of prevention and treatment of pediculosis capitis. Control programs should also involve the community nurses, physicians, public health doctors, and teachers to promote self-diagnosis and treatment in children and their families. It is probably impossible to prevent all head lice infestations. Young children come into head-to-head contact with each other frequently. The school health team should be responsible for treating and preventing the lice infestation besides carrying out other school health services functions. Infested children should be treated promptly to minimize spread to others.

CONCLUSION

The overall prevalence of pediculosis capitis among the primary school students in Hulu Langat, Selangor is high (15.3%). The positive predictors for infestation with pediculosis capitis are age group, gender, ethnicity and having contact with someone infested. This study has added to the existing scientific knowledge on factors associated with pediculosis capitis. The findings indicate that there is need for revision and improvement in public health policies for the prevention and treatment of pediculosis capitis.

The findings from the study should be disseminated to the Ministry of Health Malaysia and Ministry of Education. There should be periodic screening of pediculosis and other associated risk factors like hygiene practice and previous contact with infested person so that they can be managed early to prevent further infestation. A wider study covering Selangor state or Malaysia is recommended so that the results can be more generalized.

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