

Prevalence and Risk Factors Associated with Head Louse (*Pediculus humanus capitis*) among Primary School Girls in Qom Province, Central Iran

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Abstract

Background: Head louse infestation is highly common in collective centers such as schools, garrisons and campuses. This study was done to determine the prevalence and risk factors associated with *Pediculus humanus capitis* in primary school girls in Qom Province central Iran.

Materials and Methods: This descriptive –analytic study was conducted among 1,725 feminine primary students from 89 schools of Qom province, Central Iran were randomly selected during 2015 to 2017. Data collection was done using standard check list that was provided by the Iran Centres for Disease Control and Prevention (CDC), and physical exams of the hair by visual scalp examination. Head examinations were performed by medical entomologist experts. Analysis of data was done using SPSS version 20.0 software.

Results: The prevalence rate of infestation was 13.28%. The rate of head lice infestation was 13.73% in the urban areas and 10.22% in the villages. According to the multivariable logistic regression analysis, a significant relationship was observed between *Pediculus capitis* and each of these factors: family size, water source, family income (per month for each family, in US dollars), father occupation, parental education, access to primary health care services, having previous history of *Pediculus capitis* infestation, number of comb uses per day ($p < 0.05$).

Conclusion: The head lice infestation is a significant public health issue in primary school girls of Qom province. Risk factors associated with head louse among primary school girls were some demographic and socioeconomic factors. Improvement of these status and designing and implementing appropriate educational and preventive programs can be helpful for surveillance of infestation among primary school girls.

Key Words: Head lice infestation, Iran, Pediculosis, Primary school, Students.

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1- INTRODUCTION

Human lice are a group of small bloodsucking insects that live on the skin of mammals and birds. They can survive far from their host body just for a short time period (1). Three species of lice have adapted themselves to humans are included: head louse (*Pediculus humanus capitis*), body louse (*Pediculus humanus corporis*), and crab or pubic louse (*Phthirus pubis*). The presence of lice on human body or head is called pediculosis (2). Human head lice have a history of several thousand years; for instance, nit combs have been found in Egyptian mummy; there are some hints about human lice and recommendation to control of them (3).

Head lice infestation, especially, in primary school students and their families is one of the health problems of the big cities where people living in overcrowded, unhygienic conditions with low hygiene facilities (4). Head lice have a global distribution but it seems bothers people in tropical and sub-tropical regions where, have moderate weather conditions whereas human body lice are rarely reported among the recent years because of promotion of the life standards (5). The symptoms of head lice infested are included: fatigue, intense irritation, severe itching, paranoia and lethargy (6). Because, it is a blood feeding insect and feed on blood several times a day and its saliva is injected into the body repeatedly.

Consequently, repeated inoculation of the louse saliva may cause allergies and severe itching. Furthermore, the feces dust in inspired can cause symptoms like allergic rhinitis (7). Head louse infestation is spread worldwide including Iran especially in congested areas with poverty and low sanitary conditions (8). Head lice infestation can be common in all people of developing countries (9); but it is more prevalent in overcrowded community such as primary schools (8). The previous studies in Iranian students have shown that

the reported prevalence of head lice were been varied between 1.6 to 67.3 % (8, 10, 11). It also previously proved that there are some risk factors associated with *Pediculus humanus capitis* (*P.h. capitis*) in all of communities in the world such as occupation, combing per day, bathing per week, itching sensation, family size, presence or absence of health education and pediculosis occurrence (12-14).

Because of several reports of Qom province health center that reporting head lice infestation in feminine primary schools of urban and rural areas; in order to elevate the health level of the students and to help the province health authorities for a more precise program to control this health burden in future; this study was designed to determine prevalence and risk factors associated with head louse (*Pediculus humanus capitis*) among primary school girls in Qom province, central Iran.

2- MATERIALS AND METHODS

2-1. Study design and population

Qom as one of the 31 Provinces of Iran, with an area of 11,237 km² is located in the central part of Iran with provincial capital in the city of Qom, 125 km south east of Tehran (15,16) (**Figure.1**). Based on the last census in 2016, this province had a population of approximately 1,200,000 out of which 91.2 % resided in urban areas and 8.8 % in rural vicinities.

The province contains one city, five counties, nine rural districts, and 256 villages based on reports of Iran Meteorological Organization, 2015. This descriptive –analytic study was conducted over 1,725 feminine primary students from 75 schools of Qom province, Central Iran were randomly selected during March 2015 to March of 2017.



Fig. 1. Location of Qom province in Iran (left) and its geographical situation (right).

2-2. Methods

In association with the schools health department of Qom Provincial Health Center and Education and Training Administration of Qom province, the necessary permits to enter the feminine school were obtained. A multistep, stratified cluster random sampling method was applied to gather the data. According to this method, 89 schools were selected among all 260 feminine primary schools in all rural and urban districts of Qom province. Based on previous studies (11,17), 1,500 cases in urban area and 225 cases in rural areas in order to have samples appropriate to the population of each primary school and to include all classrooms and according to the number of students in each rural county. The feminine students were selected from the log list (30 cases in each school and six in each grade from different educational grades and questioned and examined in the school administrative room in accompany with the school director or one of the teachers. The infested students were involved with the head louse in one of its life cycle stages (such as nit, nymph or

adult insects) or presence the egg/nit in the distance of 1.4 inch from the scalp for nearly three-five minutes (18). Data collection was done using standard check list that was provided by the Iran Centers for Disease Control and Prevention (CDC) and physical exams of the hair by visual scalp examination. Head examinations were performed by medical entomologist experts. The pupils' scalp and hair were inspected by two trained health workers under the supervision of medical entomologist. So the individuals' hairs, concentrating on the hairs behind neck and around the ears were investigated for five minutes to detect nit, nymph or matured lice by direct observing method. Meanwhile we have minded some information about hair condition and the study factors such as habit, type of school, parents job and educational level, family size, number of persons who sleep together, having bathroom in home or not, bath times, number of daily combs, having shale and itch or not, hair length, so on by filling the standard check list that was provided by the CDC of Iran.

2-3. Ethical consideration

Firstly, the permission letter from education and training office of Qom province was taken. It should be mentioned that before the start of the study, the aim of the study was demonstrated and the target group were ensured about the confidentiality of their data.

2-4. Inclusion criteria

The inclusion criteria were designed of being students suspected to head lice infestation who were educated in urban or rural primary feminine schools of Qom province and being satisfied to participate in the study.

2-5. Exclusion criteria

The exclusion criteria were included; just partial completing of the questionnaire

and unwillingness for participation in current study.

2-6. Data Analyses

Analysis of data was done using Chi-square and Multiple logistic regression model tests, using SPSS version 20.0 software. The variables with significant level of lower than 0.2 in univariate regression analysis were entered into multiple logistic regressions model. P-value less than 0.05 was considered

3-RESULTS

In total, 229 out of 1,725 survived students were infested with head lice. The prevalence of head lice infestation in primary school girls was 13.28%. The age of the students ranged from 7 to 11 years. The total number of the infected group was 229 with mean age of 9.24 ± 2.43 years, and it was 1,496 with mean age 8.64 ± 2.82 years in the uninfected group who were enrolled in the study ($p > 0.05$). The most of infestation was found in fifth grade (17.10%). The highest pediculosis rate (17.63%) was detected among students living in families with six or more than six members. In term of living area, the rate of head lice infestation was 13.73% in the urban areas and 10.22% in the rural areas.

Also, 86 (13.67%) of people who resident in rental house were involved with pediculosis. The prevalence of head lice infestation was higher in students with a lower family income, having parents with a low educational level, and living with three or more siblings ($p < 0.05$). A total of 160/1725 (17.62%) of head lice infested cases were people who lived in families with family income (per month for each family, in US dollars) lowers than 300 dollars. In terms of parent's educational levels, the mother's educational level of

24.28% cases and father's education level of 25.58% cases was illiterate. The prevalence of disease was 49.61% in individuals who had employed mothers ($p < 0.05$). Totally, 41.50% of cases had history of infestation and majority of them (67.64%) had no access to primary health services. The results showed that 43.18% of head lice infested people did not comb their head hair per day and 20.11% of them had bathing once or less per week (**Table. 1**). In this study 87.5% of cases were reported from governmental health centers (Community Health Centers). The result of univariate regression analysis showed that there was a significant relation between head louse infestation and family size, water source, Family income (per month for each family, in US dollars), parental occupation, parental educational level, history of infestation, access to primary health services, number of combing per day and bathing per week ($P < 0.05$) (**Table. 1**).

Other socio-demographic features of the study subjects were presented in **Table.1**. The variables that were significant level lower than 0.2 in univariate regression analysis were entered to multiple logistic regressions model. The results of the model indicated that head lice infestation risk factors were included: family size ($p < 0.001$), water resource ($p < 0.002$), family income ($p < 0.001$), father's educational level (0.02), mother's education (0.041), access to primary health services ($p < 0.001$), history of infestation ($P < 0.001$), number of combing per day ($p < 0.001$), and mother educational level (university level) only was as a preventive factor. Also, there was no observed relation between head louse infestation and mother's occupation, and bathing per week ($p > 0.05$) (**Table. 2**).

Table-1: The socio-demographic features of the study subjects and the prevalence of *pediculosis capitis* among feminine primary schools of Qom province

Variables	Level	Total	<i>Pediculosis capitis</i> frequency		P-value
			Number	%	
Age (Year)	7	345	52	15.07	0.874
	8	347	36	10.37	
	9	343	42	12.24	
	10	344	38	11.05	
	11	346	61	17.63	
Educational grade	I	345	54	15.65	0.542
	II	345	35	10.14	
	III	345	42	12.17	
	IV	345	39	11.30	
	V	345	59	17.10	
Family size	3 persons	201	24	11.94	<0.048
	4 persons	505	63	12.47	
	5 persons	741	93	12.55	
	6 or more than 6 persons	278	49	17.63	
Type of house	Private	1096	143	13.04	0.822
	Rental	629	86	13.67	
Living area	Urban	1500	206	13.73	0.764
	Rural	225	23	10.22	
Water source	Public tube	43	13	30.23	<0.002
	Own	1682	216	12.84	
Family income (per month for each family, in US dollars)	Poor (< \$300)	908	160	17.62	<0.041
	Good (\$300–600)	334	50	14.97	
	Fine (> \$600)	483	19	3.93	
Father's occupation	Unemployed or died	119	32	26.89	<0.002
	Self-employed	1142	157	13.75	
	Governmental-employed	464	40	8.62	
Mother's occupation	Housewife	1596	165	10.33	<0.001
	Employed	129	64	49.61	
Father's education	Illiterate or died	172	44	25.58	<0.003
	Initial education	906	140	15.45	
	University education	647	45	6.95	
Mother's education	Illiterate or died	210	51	24.28	<0.002
	Initial education	1027	149	14.51	
	University education	488	29	5.94	
History of infestation	Yes	212	88	41.50	<0.001
	No	1513	141	9.32	
Access to primary health care services	Yes	1691	206	12.18	<0.001
	No	34	23	67.64	
Number of combing per day	None	44	19	43.18	<0.001
	Once	997	159	15.95	
	Twice	407	35	8.60	
	Three and more	277	16	5.77	
Bathing per week	Once or less	512	103	20.11	<0.001
	Twice	1136	119	10.47	
	More than twice	77	7	9.09	

Table-2: Multivariable logistic regression analysis of the relationship between *pediculosis capitis* infestation and potential risk factors feminine primary schools of Qom province during 2015-2017.

Variables	Level	Pediculosis n (%)	β	SE	OR (95%CI)	P-value
Family size	3 persons	24 (11.94)			1	
	4 persons	63 (12.47)	0.34	0.01	1.12 (1.08-1.46)	<0.001
	5 persons	93 (12.55)	0.26	0.31	1.55 (1.27-1.88)	<0.001
	6 or more than 6 persons	49 (17.63)	1.36	0.44	1.98 (1.57-2.50)	<0.001
Water source	Public tube	13 (30.23)			1	
	Own	216 (12.84)	0.068	0.34	1.54 (1.44-2.48)	0.02
Family income (per month for each family, in US dollars)	Poor (< \$300)	160 (17.62)			1	
	Good (\$300–600)	50 (14.97)	0.61	0.26	2.39 (1.41-4.08)	0.001
	Fine (> \$600)	19 (3.93)	0.42	0.38	1.50 (1.23-1.84)	<0.001
Father's occupation	Unemployed or died	32 (26.89)			1	
	Self-employed	157 (13.75)	0.34	0.21	0.72 (0.58-1.06)	0.01
	Governmental-employed	40 (8.62)	0.26	0.31	0.55 (0.27-0.88)	0.02
Father's education	Illiterate or died	44 (10.33)			1	
	Initial education	140 (49.61)	0.61	0.26	0.39 (0.41-1.08)	0.03
	University education	45 (25.58)	0.42	0.38	0.50 (0.23-0.84)	0.02
Mother's occupation	Housewife	165 (15.45)			1	
	Employed	64 (6.95)	0.052	0.42	0.35 (0.23-1.49)	0.052
Mother's education	Illiterate or died	51 (24.28)			1	
	Initial education	149 (14.51)	0.041	0.39	1.54 (1.22-2.87)	0.017
	University education	29 (5.94)	0.051	0.44	1.28 (1.11-2.33)	0.041
Access to primary health care services	Yes	206 (12.18)			1	
	No	23 (67.64)	1.02	0.42	1.36 (1.24-2.60)	0.023
History of infestation	Yes	88 (41.50)			1	
	No	141 (9.32)	1.36	0.44	2.18 (1.16-3.48)	<0.001
Number of combing per day	None	19 (43.18)			1	
	Once	159 (15.95)	0.61	0.26	1.71 (1.31-2.47)	0.04
	Twice	35 (8.60)	2.29	0.28	3.14 (2.25-5.34)	<0.001
	Three and more	16 (5.77)	2.77	0.38	4.46 (1.31-15.05)	<0.001
Bathing per week	Once or less	103 (20.11)			1	
	Twice	119 (10.47)	0.051	0.44	1.35 (1.03-2.49)	0.053
	More than twice	7 (9.09)	0.061	0.26	0.81 (0.46-1.44)	0.065

β : Slope; SE: Standard Error; OR: Odds Ratio ; CI: Confidence Interval.

4- DISCUSSION

The data presented in this study showed that the prevalence of head lice infestation among primary school girls in Qom province was 13.28 %. The previous epidemiological studies have shown that the prevalence of *P.h. capitis* were 0.7% to 59% in Asian, 0.48% to 22.4% in European, 3.3% in 0% to 58.9% in African, 3.6% to 61.4% in American

countries (19). Additionally, the results showed that its prevalence among primary school girls were 13.1% in Kayseri, Turkey (20), 60.6 % in Assiut, Egypt (13), 23.2% in Thailand (21), and 4.1% in Korea (22). Previous studies in deferent areas of Iran have been showed, prevalence of head lice were being varied between 1.6 to 67.3 % (8, 10, 11). Therefore, the prevalence of head lice infestation among primary school

girls in Qom Province is moderate in comparison to other areas of Iran. As the present data suggest that the prevalence of pediculosis can be varied in different regions, it is also possible that prevalence variety of head lice infestation was caused by other probable factors such as climate change, geographic zones, welfare, and access to health care, marginalization and creation of satellite towns. According to the results of present study, the rate of head lice infestation was 13.73% in the urban areas and 10.22% in the rural areas. This finding is in agreement with Moradiasl et al. (2018) (11).

It seems that in primary school girls in Qom province, health education continuously in rural areas by health care providers (Behvarzan) has been effective in raising the awareness of students and their families about the prevention of in head lice infestation and it led to human head lice reduction. In rural areas, health care providers also check the health status of students at least once in a season. In urban areas, this is the responsibility of health educators from schools or other health personnel, who regularly do not visit and monitor students. The present data demonstrate that, most of cases were reported from governmental health centers, also known as Community Health Centers.

According to the protocol of Iranian Ministry of Health and Medical Education, Center for Disease Control, pediculosis is one of the non-emergency reportable diseases (23). It seems, low cost health care services provided in the governmental health centers and availability rate of these health centers may be the cause of this situation. The results of the multiple logistic regression indicated that head lice infestation risk factors were included: family size, family income, mother educational level (initial level), history of infestation, access to primary health services, and number of combing per day. However other data show that the most of

pediculosis rate (more than 17%) were founded among students living in families with six or more than six members, whereas about 11% of families with three members were infested. This is in agreement with Gulgun et al. (2013), who mentioned that having more family members can cause higher infestation rates because parents, have less time per a child to provide personal hygiene. Overcrowding facilitates transmission of pediculosis due to closer contact with siblings in the house (20). According to the results of the present study, the prevalence of head lice infestation was higher in students with a lower family income, having parents with a low educational level, and living with three or more siblings. Also, this finding has shown previously (20).

Because of the family income level which is highly related to the family hygiene status. Our results showed that an increased pediculosis prevalence in children who resident in families with family income (per month for each family, in US dollars) lowers than 300 dollars. The present results indicate that in terms of parent's education levels, mother's educational level of 24.28% cases had no formal education. Several studies have been conducted mainly in relation of socio- demographical status of people such as their educational level on head lice infestation (20, 24).

The results of the study indicate that, more than 40% of cases had history of infestation and majority of them (67.64%) had no access to primary health services. The results are in agreement with the results of Rafinejad et al. (2006), and Kassiri et al. (2015) studied (1, 25), that mentioned these factors can be two risk factors for morbidity again. Recent investigations have indicated that one of probable related factors for morbidity again is probability of anti-lice products resistance (26-28). However, further epidemiological works will be necessary to

confirm this hypothesis in our study area. It is probable that some of infested people in the previous period of infestation are not getting the full treatment. Also, it should be concluded that if, after a treatment period using permethrin shampoo according to its guide lines and catalog of manufacturer company, head lice infestation did not remove, it means that head lice infested person or people are living in near where of this infested cases have been resident and the probable sources of infection still is not gone (23). Of course this hypothesis should be studied and was entomologically estimated in future. The present data/results indicate that more than 40% of head lice infested people did not comb their head hair per day and 20.11% of them had bathing once or less per week. Head lice infestation is still a considerable health burden in low socioeconomic societies.

4-1. Limitations of the study

The present study was designed on 1,725 students in some of primary feminine schools of Qom province, Iran. It makes the findings, can reveal just some of the status of pediculosis in Qom province. So, it can be one of the limitations of the present research.

5- CONCLUSION

According to the findings, the head lice infestation is a significant public health issue in primary school girls of Qom Province, central Iran. Risk factors associated with head louse among primary school girls were some demographic and socioeconomic factors such as family size, water source, family income (per month for each family, in US dollars), father occupation, parental education, access to primary health care services, having previous history of *Pediculus capitis* infestation, number of comb uses per day. Improvement of these status and designing and implementing appropriate educational and preventive programs can be helpful for

surveillance of infestation among primary school girls. Based on the results obtained, our suggestions are as follows: using health educators in all primary school girls, surveillance of health status of students at least once in a season regularly by health educators, providing health education programs especially in schools and persuading the students to health behaviours like routine daily bath, daily hair combing and so on.

6- CONFLICT OF INTEREST: None.

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8- REFERENCES

1. Rafinejad J, Noorolahi A, Javadian E, Kazem nezhad A, Shemshad Kh (2006) Epidemiology of pediculus humanus capitis infestation and effective factors in elementary schools of children, Amlash district, Gilan province. Iran J Epidemiol 2006; 1 (4): 51- 63.
2. Sangaré AK, Doumbo OK, Raoult D. Management and Treatment of Human Lice. BioMed Research International 2016; 2016:8962685.
3. Raoult D, Reed DL, Dittmar K, Kirchman JJ, Rolain JM, Guillen S, Light JE. Molecular identification of lice from pre-Columbian mummies. J Infect Dis 2008; 197(4):535-43.
4. Brouqui P. Arthropod-borne diseases associated with political and social disorder. Annu Rev Entomol. 2011; 56:357-74.

5. Boutellis A, Abi-Rached L, Raoult D. The origin and distribution of human lice in the world. *Infect Genet Evol* 2014; 23:209-17.
6. Muhammad Zayyid, M, Saidatul Saadah R, Adil AR, Rohela M, Jamaiah I. Prevalence of scabies and head lice among children in a welfare home in Pulau Pinang, Malaysia. *Tropical Biomedicine* 2010; 27(3): 442–46.
7. Rukke BA, Soleng A, Lindstedt HH, Ottesen P, Birkemoe T. Socioeconomic status, family background and other key factors influence the management of head lice in Norway. *Parasitol Res* 2014; 113(5):1847-61.
8. Moosazadeh M, Afshari M, Keianian H, Nezammahalleh A, Enayati AA. Prevalence of Head Lice Infestation and Its Associated Factors among Primary School Students in Iran: A Systematic Review and Meta-analysis. *Osong Public Health Res Perspect* 2015 6(6): 346–56.
9. Saghafipour A, Nejati J, Zahraei Ramazani A, Vatandoost H, Mozaffari E, Rezaei F. Prevalence and Risk Factors Associated with Head Louse (*Pediculus humanus capitis*) in Central Iran. *Int J Pediatr* 2017; 5: 5245-54.
10. Soleimani-Ahmadi M, Jaberhashemi SA, Zare M, Sanei-Dehkordi A. Prevalence of head lice infestation and pediculicidal effect of permethrine shampoo in primary school girls in a low-income area in southeast of Iran. *BMC Dermatology* 2017; 17:10.
11. Moradiasl E, Habibzadeh Sh, Rafinejad J, Abazari M, Sadeghieh Ahari S, Saghafipour A, et al. Risk Factors Associated with Head lice (*Pediculosis*) Infestation among Elementary School Students in Meshkinshahr County, North West of Iran. *Int J Pediatr* 2018; 6(3): 7383-92.
12. Ramos JM, Moles-Poveda P, Tessema D, Kedir M, Safayo G, Tesfasmariam A, Reyes F, Belinchon I. Skin problems in children under five years old at a rural hospital in Southern Ethiopia. *Asian Pac J Trop Biomed* 2016; 6(7):625-29.
13. Mohamed El Magrabi N, Abdullah El Houfey A and Rashad Mahmoud S. Screening for Prevalence and Associated Risk factors of Head lice among Primary School Student in Assiut City. *Adv. Environ. Biol* 2015; 9(8): 87-95.
14. Lesshafft H, Baier A, Guerra H, Terashima A, Feldmeier H. Prevalence and Risk Factors Associated with *Pediculosis capitis* in an Impoverished Urban Community in Lima, Peru. *J Glob Infect Dis* 2013; 5(4): 138–43.
15. Saghafipour A, Nejati J, Mozaffari E, Rezaei F, Gharlipour Z, Mirheydari M. The Effectiveness of Education Based on BASNEF Model on Promoting Preventive Behavior of Cutaneous Leishmaniasis among Students. *Int J Pediatr* 2017; 5(6): 5125-36.
16. Farzinnia B, Saghafipour A, Abai M. Malaria Situation and Anopheline Mosquitoes in Qom Province, Central Iran. *Iran J Arthropod-borne Dis* 2010; 4: 61-7.
17. Kassiri H, Gatifi A. The Frequency of Head Lice, Health Practices and its Associated Factors in Primary Schools in Khorramshahr, Iran. *Health Scope* 2016; 5(4): e31570.
18. Pollack RJ, Kiszewski AE, Spielman A. Overdiagnosis and consequent mismanagement of head louse infestations in North America. *Pediatr Infect Dis J* 2000; 19: 689-93.
19. Matthew E. Falagas, Dimitrios K. Matthaiou, Petros I. Rafailidis, George Panos, Georgios Pappas. Worldwide Prevalence of Head Lice. *Emerg Infect Dis*. 2008; 14(9): 1493–94.
20. Gulgun M, Balci E, Karaoğlu A, Babacan O, Türker T. *Pediculosis capitis*: prevalence and its associated factors in primary school children living in rural and urban areas in Kayseri, Turkey. *Cent Eur J Public Health* 2013; 21(2):104-8.
21. Watcharawit R , Mayura S. Epidemiology of pediculosis capitis among schoolchildren in the eastern area of Bangkok, Thailand. *Asian Pac J Trop Biomed* 2012; 2(11): 901–4.
22. Oh JM, Lee IY, Lee WJ, Seo M, Park SA, Lee SH, et al. Prevalence of pediculosis capitis among Korean children. *Parasitol Res*. 2010; 107:1415–19.
23. Amirkhani MA, Aminaei T, Ardalan G, Dashti M, Islami M, Jamali M, et al. Guideline to prevention and treatment of lice infestation. 1nd ed. Iran: Seda Publishing Center; 2009: 23-24.

24. Willems S, Lapeere H, Haedens N, Pasteels I, Naeyaert JM, De Maeseneer J et al . head lice in schoolchildren. *European J Dermatol* 2005; 15: 387-92.

25. Kassiri H, Kasiri A, Kasiri N, Moeininejad F. Epidemiology and Morbidity of Head Lice Infestation in Khorram-shahr County, Iran (2006-2009). *J Health Sci Surveillance Sys* 2015; 3(2): 83-7.

26. Bailey AM, Prociv P. Persistent head lice following multiple treatments: evidence for insecticide resistance in *Pediculus humanus capitis*. *Australas J Dermatol* 2000; 41(4):250-4.

The importance of socio-economic status and individual characteristics on the prevalence of

27. González Audino P, Barrios S, Vassena C, Mougabure Cueto G, Zerba E, Picollo MI. Increased monooxygenase activity associated with resistance to permethrin in *Pediculus humanus capitis* (Anoplura: Pediculidae) from Argentina. *J Med Entomol* 2005; 42(3):342-5.

28. Picollo MI, Vassena CV, Mougabure Cueto GA, Verneti M, Zerba EN. Resistance to insecticides and effect of synergists on permethrin toxicity in *Pediculus capitis* (Anoplura: Pediculidae) from Buenos Aires. *J Med Entomol* 2000; 37(5):721-5