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Head lice among governmental primary and middle school students in Garmsar, Semnan Province: Prevalence and risk factors

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Abstract---The prevalence of head lice (*Pediculus humanus capitis*) is one of the most common infections at all ages, especially among students, and is widespread worldwide. This study aimed to investigate the prevalence of head lice infection and external factors affecting the distribution of *P.capitis* in girls' schools in Garmsar city and east of Semnan province (Iran) from October 2017 to April 2018. This study was descriptive and analytical. A total of 850 students aged 7 to 16 from 14 selected girls' schools were screened for head lice. Data collection was performed using a standard questionnaire and physical examination of hair. A questionnaire was completed about

the personal health practices and socio-demographic characteristics of students. Analysis was performed using the chi-square test and SPSS software version 18. The overall prevalence of head lice infection in Garmsar city was approximately 33.17%. This prevalence in elementary and middle school students was 41.66% and 12.8%, respectively. There was a statistically significant relationship between pediculosis capitis and the occupation of mothers with the level of education, father's occupation, and the presence of health teachers in schools, bathing intervals, combing intervals, access to health services, and school score. This study showed that the prevalence of pediculosis is a major concern, but among the schools studied, the prevalence of head lice in primary schools was slightly higher, which is related to factors such as personality traits and poor education. To find solutions to this issue, given its cultural, economic, and social dimensions, the cooperation of various agencies such as the Ministries of Education and Health, as well as students and their parents, is necessary.

Keywords---head lice prevalence, Pediculosis capitis, Risk factors, primary and middle school, Iran.

1. Introduction

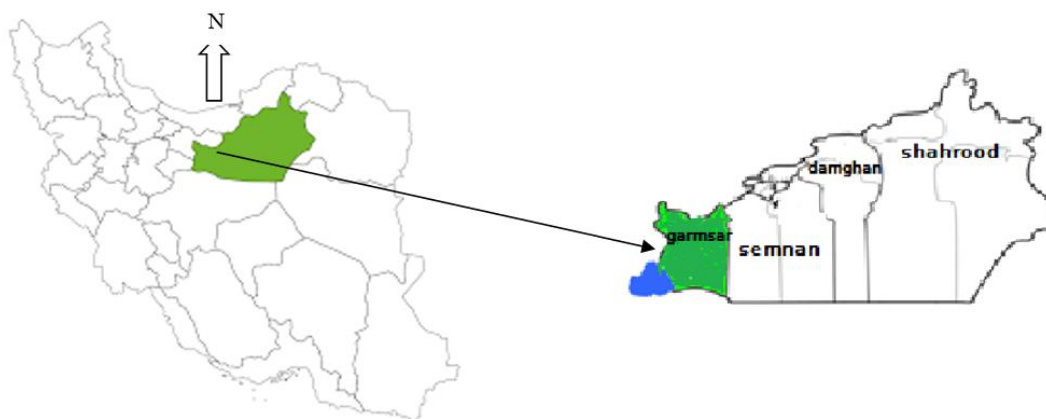
P. humanus capitis is a public health concern in many communities around the world [1,2]. Pediculosis represents an emerging social problem in all parts of the world and any race, socioeconomic status, family history, or personal habit [1][3-5]. Pediculosis capitis is an infection caused by the ectopic parasite *Pediculus humanus capitis* (*P.h. capitis*), which attaches to the human host at all stages of life and feeds only on human blood, has no wings, cannot fly, and lives in human hair [3]. In addition, head lice are more active at lower temperatures and they are usually exposed to the scalp, where the temperature is lower than inside clothing [4]. Head lice are usually spread directly through direct head-to-head contact with an infected person or indirect transmission by sharing hairbrushes, hats, mats, towels, bedsheets, clothing, comb, pillow, or other personal belongings [5,6]. Apart from causing severe irritation and itching of the scalp that may lead to secondary bacterial infections, *P. humanus capitis* may be a carrier of some bacterial agents such as *Rickettsia prowazekii* and *Borrelia recurrent* that may cause life-threatening infections in humans [7]. Head lice infection is usually identified by three types of evidence: itching and inflammation of the scalp and neck, sighting of lice, and diagnosis of oocytes attached to the hair shaft [5]. Therefore, timely diagnosis and treatment of this infection are important to control the infection and the physical and mental health of patients. So severe chronic infection among students may lead to anemia and obvious complications among students around the world [3,8]. Because elementary school students come together in classrooms and have high contact rates, *P.h. capitis* transmission occurs frequently [3,6]. However, head lice are a common infection in school-age children worldwide [9]. In studies by Falagaset al. (2008), according to the global prevalence of lice infestation in the 21st century, in Asia, the prevalence ranged from 0.7% to 59% and was higher in females and women, in Europe, the prevalence ranged from

0.48% to 22.4% and in Africa, the prevalence ranged from 0% to 58.9% and was higher in women. The mean prevalence of head pediculosis in Asia was $15.1\% \pm 12.8\%$ [10]. In high-income countries, school children aged 3 to 11 are often affected despite medical advances [10]. According to the results of an epidemiological study, the prevalence of head lice is estimated at 4.8% (Netherlands), 35% (Brazil), 1.2% (Turkey), 28.8% (Venezuela), and 29.7% (Argentina) [11]. In addition, head lice infestation has been reported from different parts of Iran. The results of studies conducted in Iran show that the prevalence of head lice is 6.85% (Hamedan)[12], 12.27% (Bandar Abbas) [13], 4% (Urmia) [14], 8/27% (Ardabil) [15], and 4.7% (Sanandaj) [16]. Therefore, according to the results of studies conducted worldwide, in assessing the prevalence of lice, socio-economic and educational factors, the availability of health services, physical and environmental conditions of residential households should be considered [17]. This study was performed to investigate the prevalence of head lice infection and some risk factors related to the rate of infection such as social and economic status, gender, hair characteristics, personal hygiene, and physical health in female school students in Garmsar city of Semnan province, Iran.

2. Materials and Methods

2.1. Study area

Garmsar is a city in Semnan province in Iran. It is located at latitude 34:28 - 34:30 North and longitude 51:52 - 52:55 minutes east and an altitude of 1170 meters. The geographical area of this section is 10686 square kilometers and has a population of 48672 people, it is the fourth largest city of Semnan. The climate is hot and dry in summer and mild in winter with an average annual temperature of 17.4 °C and an average annual rainfall of 100 mm. (Fig.1).



2.2. Research design

A cross-sectional descriptive study was conducted from October 2017 to April 2018 in 14 girls' schools (10 primaries and 4 middle schools) in Garmsar city, Semnan province. Cluster sampling was considered in some parts of the city to form a cluster. Girls' schools in each cluster were randomly selected. A total of 10 students from first to ninth grade were examined. All examinations were

performed with the permission of teachers and health educators. Data were obtained by observation and multi-stage sampling.

2.3. Examination

The examination was performed and confirmed by at least two trained examiners under the supervision of a medical entomologist. The diagnosis of lice infestation was confirmed by clinical examination of the scalp and hair under the light of a study lamp and using a magnifying glass for the presence of nits and nymphs or adult lice for approximately 5 minutes. To detect head lice infection, the whole head was carefully examined for the presence of adult lice, nymphs, or viable nits. Head lice lay nits within a few millimeters of the scalp [18]. Hair shafts on the back of the head, neck, and behind the ears should be examined at a distance of 3 to 4 mm from the scalp using a fine-toothed comb. After the examination, the children were treated with herbal shampoo (anti-head lice shampoos such as g permethrin 1% and lindane 1%).

2.4. Questionnaire

After the physical examination, a special questionnaire was completed for the students. The questionnaire included socio-demographic information related to age, children's personal health measures, factors related to lice infestation, family characteristics, and socio-economic status.

2.5. Data Entry and Statistical Analysis

The data were examined using SPSS software version 18 on Windows 7 and statistical tests such as chi-squared (χ^2) to assess the degree of connection between infestation rates and the student's age, socio-demographic variables, and factors linked with head lice infestations.

3. Results

3.1. Socio-demographic characteristics

Table 1 shows the socio-demographic data. In Garmsar, west of Semnan, 850 students (689 elementary students and 161 middle school students) were chosen for *P. capitis* from 14 schools. Students ranged in age from 7 to 16, with a mean SD (11.5 3.36) year. The majority of those who took part were children living with their parents. About 5% of the participants were not Iranian.

3.2. Prevalence of head lice infestation and related factors with head lice infestations

Table 1 shows the link between head lice infestation and probable causes of infection in 800 girls. Socio-demographic factors influenced the prevalence of lice infestation. The impact of academic grades, students' parents' educational levels, health instructors' availability, social and economic aspects of families, family size, and parents' employment on the frequency of head lice among students was explored in this study. Although there was no significant association between the

two variables of family dimension and head lice in the statistical test, 7.19 percent of cases with more than 5 family members and 53.95 percent of students with pediculosis reside in a two-room house. Having a bathroom in the house was one of the most important issues in pediculosis because 0.72% of the positive cases did not have a toilet in their home. No significant relationship was observed between home bathing and pediculosis capitis. In terms of the education level of students' parents, students with lice had a mother with no education background or a level of elementary school

(16.66 And 27.2%, respectively). Statistical analysis showed that there was a significant relationship between pediculosis and different educational levels of student mothers ($P = 0.008$) but there was no significant relationship between pediculosis and different educational levels of student fathers. There was also no significant relationship between the prevalence of infection (nits and head lice) and family income. There was no statistically significant relationship between the prevalence of pediculosis in students and parents' occupation ($P > 0.05$). Approximately 10% of students with lice had their fathers unemployed and 90% of their fathers employed. About 21.58% of students whose mothers were employees had lice. In this study, a significant relationship was observed between head lice infection and mother occupation ($P < 0.05$).

3.3. Factors Health Public related to head lice infestations

The relationship between head lice infection and individual characteristics in 850 female students is shown in Table 2. Approximately 35% of students with lice comb their hair three times a day. Approximately 46.75% of students used shared personal items such as hair brushes, headgear, hats, etc. There was no significant relationship between contamination and shared use of personal belongings. In contrast, the prevalence of infections was associated with hair length and hairstyle (straight or wavy), and pediculosis ($P < 0.017$). On the other hand, 41.58% of students with itchy scalp had pediculosis. The Chi-square test showed a significant relationship between two variables of scalp itching and head lice infection ($P < 0.043$). About 29% of the examined students did not have access to health teachers in schools and the prevalence of pediculosis was significant among them. The Chi-square test showed a significant correlation between school health teachers and infestation ($P = 0.000$).

Table 1: Prevalence of head lice infection in 850 girls students based on socio-demographic characteristics

Variables		Head lice infection					
Owner of school		Total Governmental	No. of Infestations / total	Prevalence (%)	Confidence Interval (95%)	<i>P</i> value	Standard error
school	Primary	First	23/43	53.48	0.93-2.95	0.04	0.38
		Second	21/38	55.3	0.75-2.56	0.03	0.42
		Third	40/132	30.30	0.45-1.58	0.05	0.44
		Fourth	40/126	31.7	0.46-1.53	0.046	0.26
		Fifth	57/173	32.9	0.48-1.65	0.04	0.24

Grade	Middle	Sixth	69/177	38.98	0.34-1.45	0.06	0.27
		Seventh	13/47	27.65	0.35-1.35	0.05	0.34
		Eighth	11/58	18.95	0.85-2.53	0.052	0.38
		Ninth	8/56	14.28	0.51-2.33	0.04	0.45
Father's job	General employee	82/250	30.4	0.85-6.2	0.062	0.38	
	Company employee	147/401	36.65	0.72-5.15	0.12	0.36	
	Farmer	33/61	52.22	0.28-3.42	0.012	0.25	
	self-employed	37/113	32.74	0.68-4.42	0.15	0.28	
	Unemployed	9/25	36.0	0.75-5.42	0.23	0.24	
Mother's job	Housekeeper	295/593	49.74	0.98-5.42	0.023	0.48	
	Employed	80/257	31.12	0.42-4.25	0.021	0.25	
Father's education	Primary	11/39	28.2	0.25-2.51	0.12	0.25	
	Guidance	52/158	32.91	0.42-4.1	0.063	0.38	
	High school or diploma	127/358	35.47	0.45-5.19	0.04	0.26	
	University education	82/269	30.48	0.52-6.15	0.12	0.26	
	Illiterate	6/26	23.07	0.28-3.42	1.23	0.35	
Mother's education	Primary	12/44	27.27	0.46-1.65	0.023	0.44	
	Guidance	55/145	37.0	0.75-2.52	0.00	0.45	
	High school or diploma	154/436	35.3	0.96-5.16	0.045	0.34	
	University	55/203	27.1	0.96-6.45	0.032	0.44	
	Illiterate	2/12	16.66	0.38-3.54	0.65	0.25	
The presence of a bathroom at home	Yes	296/848	34.9	1.45-15.9	0.051	0.44	
	No	2/2	100	0.52-1.15	0.3	0.39	
Number of family member (family size)	2	4/9	44.4	3.57-9.6	0.657	0.35	
	3	63/185	34.1	0.46-2.96	0.085	0.23	
	4	153/447	34.22	6.45-0.96	0.12	0.48	
	5	58/137	42.33	0.29-3.42	0.045	0.38	
	5<	20/72	36.11	0.48-1.65	0.015	0.44	
Family income(\$/month)	Less than \$ 400	45/141	31.91	0.87-4.12	0.15	0.32	
	Between\$ 400 to \$ 650	138/534	25.84	0.48-3.98	0.23	0.36	
	More than \$ 650	51/175	29.14	1.80-2.47	0.058	0.42	

Table 2: Person characteristics related to head lice infections in 800 girl students

Risk characteristics		No. examined	No. positive	% positive	chi-squared (x ²)	P-value
Hair length > 10 cm	Yes	438	173	39.49	15.11	P=0.015
	No	412	115	27.9		

Hair Style	Straight	535	185	34.57	16.23	P=0.017
	Wavy	315	121	38.41		
Itching on scalp	Yes	214	89	41.58	6.8	P=0.043
	No	636	201	31.6		
shared personal belongings	Yes	258	106	40.08	2.388	P=0.24
	No	582	198	34.02		
Combing intervals	once per day	405	123	30.11	35.45	P=0.041
	twice per day	254	98	38.58		
	three times per day	115	78	67.82		
	None	76	26	34.21		
Bath intervals	Daily	79	19	24.05	36.79	P=0.035
	twice a week	285	85	29.82		
	Weekly	374	165	44.11		
	Two weeks and more	112	45	40.17		
School health teacher	There was	575	182	31.65	18.32	P=0.000
	There was not	275	119	43.27		
Dander	Had	323	143	44.27	5.85	P=0.56
	Had not	528	187	35.41		

4. Discussion

The overall prevalence of head lice infection in Garmsar city was approximately 33.17%. This prevalence in elementary and middle school students was 41.66% and 12.8%, respectively. As a result, the level of infection in this study showed that head lice are considered a vital public health problem among the students of both schools, especially among the elementary and middle school students compared to the students of Garmsar city. Perhaps one of the main reasons for the difference in prevalence at different levels of education is the knowledge, attitude, and proper performance of students' health. So that with the increase of awareness of students of higher levels, the rate of head lice decreases. The results of studies around the world showed different findings of head lice among primary school students. The prevalence of head lice infection in Korean primary schools was 4.1%. In this study, 6.5% of girls and 1.9% of boys had head lice infections [19]. In Turkey, the overall prevalence of head lice infection was 13.1%. Pediculosis was more common in girls (25.2%) than boys (0.86%) ($p < 0.001$) [20]. In Thailand, 23.32% of students aged 5 to 12 have head lice, and the rate of infection was higher in girls (47.12%) than in boys (0%) [5]. Studies conducted in primary schools in the provinces of Fayoum and Minofiya, Egypt reported a prevalence rate of 16.7 percent, which the prevalence is 25.8 percent higher for girls than for boys [21]. In India, 16.59% of students have head lice and the prevalence was 20.42% in girls compared to 13.86% in boys [22]. The prevalence of lice infection among primary school students is different in all the mentioned studies in Iranian cities, for example, Fars 1% [23], Kerman 3.8% [24], Babol 1.65% [25], Aran and Bidgol 0.47% [26], and the highest rate of infection was reported in girls. This result can be due to behavioral differences between the sexes, including boys' short hair compared to girls, girls' headscarves, difficulty playing, and boys' lack of intimacy, among other factors. Perhaps one of the reasons for the high

prevalence of this health problem in Garmsar schools is factors such as unfavorable geographical and climatic conditions [27]. A study conducted in primary schools in Garmsar, Semnan, showed that only 34% of schools had health care rooms, and 53% of schools showed that the distance between desks and chairs was less than the standard [28]. In another study conducted in beauty salons in Garmsar, Semnan, 1.3% of hairdressers avoided shaving and makeup if they saw a person with lice [29]. Similar studies in Ahwaz and Zabul reported pollution rates of 11% and 29.4%, respectively [30, 27]. One of the characteristics that play a role in increasing the rate of infection in girls is the length of their hair. In the present study, statistical analysis showed a significant difference between pediculosis and students' hairstyle and length. Therefore, one of the most important causes of head lice in girls is long hair. While the service believes that the rate of head lice infection does not depend on hair length [31]. Numerous studies have shown that head lice can be transmitted through close contact, children playing and frequent head contact, or the use of scarves, hats, combs, hairbrushes, and other accessories that can transmit head lice, contrary to the results of this study [32]. The results of this study showed that there is no significant relationship between the use of shared personal devices and the increase in the incidence of lice in female students. According to most research in this field, there is an inverse relationship between the incidence of head lice infection and the level of education of parents. In the study by Moradi et al. (2009), it was observed that the rate of infection is lower among children with educated parents than in children with uneducated parents [33]. In this study, the level of infection was higher in students whose mother's education level was elementary and uneducated, while there was no significant relationship between the father's education level and infection. It seems that if the household size is large, parents can pay less attention to their children's health. As a result, large families are expected to have closer contact with individuals and, have a higher prevalence. But in this study, there was no significant relationship between the number of family members and the prevalence. On the contrary, the findings of this study contradict the results of Kasiri et al. (2009)[27]. The incidence of head lice in the first and second grades was somewhat higher than in other grades so there was a significant relationship between grades and prevalence. In agreement with the present results, Rafinejad et al. (2006) and Farzinnia et al. (2004) reported that there was a significant relationship between grades and prevalence [34,35]. Our study also showed a significant relationship between access to weekly bath intervals, combing intervals, and contamination rates. Studies conducted in Gonabad, Gilan, and Ahvaz showed a significant relationship between weekly bathing intervals and head lice infestation [27,34,36]. In studies conducted in Qom and Sanandaj, a significant relationship was observed between pediculosis and hairbrush [37,38]. Because lice stick to the hair and secrete allergens, itching is the most common sign of head lice infection and is a good sign to diagnose head lice in female students. According to our data, around 46% of students with lice did not have a health instructor at their school among the 12 schools surveyed. There was a substantial difference in the prevalence of head lice between pupils with and without health teachers. This could be due to health educators' ineffective presence in some schools across the country or their poor performance in controlling kids' health. In this study, we looked at the prevalence of head lice infestation based on the parents' work. Students with a farmer's father had a considerably greater rate of lice infection ($P < 0.012$). In Hamadan province [12], no

significant relationship was identified between a father's occupation and infection, while similar research in Sanandaj, Qom, and other regions of the world indicated a substantial relationship between pediculosis and parents' occupation [37,38]. The presence of health teachers in schools, bathing intervals, combing intervals, access to health services, maternal literacy, hair type, school grade, and parents' occupation ($p < 0.05$) all play a role in the high prevalence of the disease in Garmsar girls' schools, according to the findings of this study.

5. Conclusion

According to the findings of this study, factors such as the presence of health educators in schools, frequency of bathing, access to health services, increased income, and education level of parents have played a significant role in the relatively high prevalence of the disease in girls' primary schools in Garmsar. Therefore, to reduce this problem, there is an urgent need for macro-health planning such as hiring health educators in all schools, and increasing people's access to health services along with personal health measures and health education.

Conflict of interest statement

We declare that we have no conflict of interest.

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