

## Original Article

**Prevalence of *Pediculus humanus capitis* and associated risk factors among elementary school-aged girls in Paveh, West Iran**Gona Bekri<sup>1</sup>, Abdolreza Shaghaghi<sup>1</sup><sup>1</sup> Health education and Promotion Department, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran**Abstract**

**Introduction:** Head lice infestation is considered as a common dermatological health problem worldwide. This study was aimed to determine the pediculosis prevalence and associated risk factors among school-aged girls enrolled in public elementary schools of the city of Paveh, Kermanshah province, West Iran. The study findings will provide an evidence base, upon which a multifaceted intervention against pediculosis can be formulated and implemented.

**Methodology:** In this cross-sectional study, 361 elementary school-aged girls were recruited from October to December 2018 at the beginning of the school year. Diagnosis was made by visual inspection. A structured questionnaire was utilized to collect data about past history of infestation and associated factors.

**Results:** A total of 26/361 (7.2%; 95% CI: 4.50-9.90) suffered from pediculosis. Pediculosis was associated with the history of previous infestation (OR: 6.12; 95% CI: 2.68-13.99;  $p < 0.001$ ), low frequency of bathing (OR: 7.90; 95% CI: 3.36-18.60;  $p < 0.001$ ), low frequency of hair combing (OR: 3.64; 95% CI: 1.56-8.50;  $p = 0.004$ ), screening of the student's hair by parents at home (OR: 0.39; 95% CI: 0.19-0.78;  $p < 0.001$ ) and with the absence of screening by the school health officer in the schools (OR: 7.16; 95% CI: 2.91-17.61;  $p < 0.001$ ).

**Conclusions:** Synchronized efforts to enhance public knowledge, periodic examination of school-aged children for pediculosis, and proper treatment of infested patients are needed to control the disease in the Iranian elementary schools. The applied strategies in low and middle income countries is suggested to be focused mainly on low cost family-based and school-based initiatives for maximum effectiveness.

**Key words:** Pediculosis; lice infestation; skin diseases; Iran.*J Infect Dev Ctries* 2022; 16(9):1506-1511. doi:10.3855/jidc.11930

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Copyright © 2022 Bekri *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**Introduction**

Head lice infestation (HLI) is considered as a common dermatological health problem worldwide [1]. Pediculosis prevalence was reported to be typically higher among school-aged children (3-11 years old) than any other age groups [2] but those in the age range of 24-36 years, who have close contacts with school-aged children, such as parents, teachers and other care givers also have a higher risk of infestation [3]. Epidemiological studies that carried out in both developed and developing countries including Pakistan, Argentina, Australia, India, Iran, England, France, Germany and Spain have indicated that girls usually show higher prevalence rate than their male counterparts [4].

The infestation prevalence connoted an ascending pattern in Iran during recent years, mainly due to destruction of health infrastructure in the neighboring countries (Iraq and Afghanistan) in consequence of internal war. There were massive waves of legal and

illegal immigrants and refugees escaping from these countries to Iran, in response to existence of unprecedented environmental, humanitarian, economic and social pressure. Most of the displaced populations, especially illegal refugees, have usually a deteriorated health status and live in extremely precarious living conditions that makes them vulnerable to many kinds of infectious and parasitic diseases, including HLI. These circumstances, along with inherent difficulties of the Iranian National Health System (INHS) in responding to the health needs of these sizable evacuees, contributed to marginalization and creation of satellite settlements with minimum health facilities in the bordering provinces (Ilam, Kurdistan, Kermanshah, Khuzestan, North Khorasan, South Khorasan and Razavi Khorasan). Poor living conditions and study in over populated public schools with low health standards are baseline precipitators of many debilitating morbidities including HLI among the school-aged children in these provinces.

Economic and social burden of the disease is extensive worldwide and it was estimated that HLI is the main underlying factor for loss of 12 to 24 million days and school absenteeism [5].

The HLI prevalence amongst the school-aged children was reported to be as high as 30% in some of the primary and secondary schools in deprived cities and provinces of Iran [6]. The cost of pediculosis control and treatment could be several hundred dollars a year [7] and consumes a large proportion of public health resources especially in underdeveloped and developing countries where scarce source of funds are available for spending in health sectors [8]. Prevention and control strategies of pediculosis in schools must be targeted at interrupting the transmission cycle. The proven suggested procedures are spacing desks and chairs in classes apart to prevent children shoulder-to-shoulder sitting, minimizing close contact games and sports during outbreaks [9,10]. Education of school aged-children and their parents could also be suggested to pose an unequivocal impact on success of interventional programs [10].

This study was aimed to determine the pediculosis prevalence and its associated risk factors among school-aged girls enrolled in public elementary schools of the city of Paveh, Kermanshah province, West Iran. The findings could provide an evidence base, upon which a multifaceted intervention against pediculosis can be formulated and implemented.

## Methodology

The study location is the city of Paveh with relatively cold and dry climate. The city has about 30,000 population [11] with 11 elementary schools. Of these, 5 schools are considered for girl students. Each of the schools has at least 150 students. A cross-sectional study was conducted from October to December 2018 and at the start of school year. The study population consisted of all female elementary school students enrolled in two selected schools from the lowest socio-economic stratum of the study population (decided based on the location of the schools in the most deprived areas of the city). The applied complete enumeration of the grade 1-6 registered children in the schools yielded 372 potential participants (age range of 6-11 years) to be recruited in the study.

Ethical approval for the conduct of this study was obtained from the institutional level Medical Ethics Board of Trustees (MEBoT) in the Tabriz University of Medical Sciences (approval code: IR.TBZMED.REC.1396.187). Formal permission was

also obtained from the Ministry of Education's local administrators, and the schools' principals were approached for discussing the study aim and objectives. All the target students' teachers simultaneously provided with information about the study procedures. Based on an agreed prearranged time table the students were acquainted with the study importance, aim and procedures. The students were also provided with an informed consent form attached to a general researcher designed questionnaire to hand over to their parents. The structured questionnaire included some questions about the parents' educational level, family size, the students' personal hygiene habits (e.g. combing hairs and bathing) and also frequency of students' hair and scalp inspection by parents or a health worker to detect HLI. After receiving the signed informed consent forms and completed questionnaires, preparations were commenced for examination of the children. The examinations were performed by the first author (GB) who is a trained school health worker and familiar with the HLI examination techniques and skills. The examinations took place in a private room within the selected schools after ensuring the students that the examination's result will be confidential, and anonymity of the participants will be maintained throughout the study.

Visual inspection of the students' hairs and scalps was performed to detect an active infestation with pediculosis capitis. Active infestation with HLI was defined based on the observation of live adult lice, nymphs, and nits at a distance of up to 4 cm from the scalp [12]. The examiner wearing disposable gloves inspected the students' hairs, scalps, neck and near the ears areas with using spatulas and under sufficient light for about 2-3 minutes. The students' study grade and student number were recorded at the examination venue.

After examination of all recruited students, several educational sessions were planned to explain the HLI routes of transmission, precautionary measures to prevent the infestation and also about treatment of the disease in a simple and understandable language for the students of different grades. For those who were diagnosed with HLI, permethrin 1% shampoo was provided free of charge to treat their disease, and proper instructions were given both to the infested students and their parents about correct use of the prescribed shampoo twice a week.

IBM SPSS statistical package version 22 [13] was utilized to tabulate descriptive statistics i.e. frequencies, percentages and to estimate odds ratios and their 95% confidence intervals for within-group comparisons and

p-values of less than 0.05 was deemed statistically significant.

**Results**

Out of 372 approached students, 361 (participation rate = 97.0%) completed the demographic questionnaire but parents of 11 students did not respond to invitation of participation in the study after two follow up calls therefore, they were precluded. HLI was found in 26 (7.20%) students. Highest prevalence was observed in grade four, and the lowest prevalence in the first grade students (Table 1). Previous history of HLI was disseminated by about 20% of the students with current signs of infestation, and by 75% of the all examined children. The education status of parents was relatively high, and only a small proportion of them were illiterate. Most participated fathers in the study were self-employed (182; 50.4%), but majority of the respondent mothers were housewives (311; 86.1%). The disclosed family size was at least 5 or higher in 28.81% of the studied school-aged children.

A statistically significant association was ascertained between presence of current HLI and the students’ personal hygiene habits. Low frequency of bathing, low frequency of hair-combing and absence of routine inspection program of the students’ hairs by a health worker indicated an increase in the odds of

infestation significantly (Table 2). A statistically convincing association was also observed between inspection of the students’ hairs for HLI by their parents and presence of current HLI.

**Discussion**

The observed prevalence of HLI (7.2%) in this study was higher than the reported prevalence rate of the infestation in some high income countries such as Norway (1.7% in both genders) [14], but markedly lower than the figure reported from a number of low income countries such as Ethiopia (75.0% among school-aged girls) [15], Thailand (15.1% in primary school-aged children:) [16] and Jordan (27.6% among elementary school-aged girls) [17]. Previous history of HLI and poor personal hygiene practices were also reported to increase chance of the infestation in previous studies [14-17].

The estimated prevalence rate of HLI in this study was slightly lower than the reported pooled estimate (8.8%) for the studied elementary school-aged girls in Iran [6]. The prevalence rate in different conducted studies in various regions, cities and provinces of the country revealed a heterogeneous pattern i.e. 6.5% in Kalaleh region [18], 29.4% in the city of Zabul (South East of Iran) [19], 22% in the city of Bushehr (South West of Iran) [20], 10.5% in the Khuzestan province

**Table 1.** Socio-demographic properties of the studied school-aged children (n = 361) and their association with head lice infestation in the city of Paveh, West Iran.

| Variables                           |             | Number of students examined | Number of infested students |       | OR    | 95% CI        | p-value  |
|-------------------------------------|-------------|-----------------------------|-----------------------------|-------|-------|---------------|----------|
|                                     |             |                             | n                           | %     |       |               |          |
| Students’ study grade               | 1*          | 61                          | 1                           | 1.64  | -     | -             | -        |
|                                     | 2           | 65                          | 3                           | 4.61  | 2.90  | 0.29 – 28.69  | 0.3618   |
|                                     | 3           | 66                          | 7                           | 10.60 | 7.11  | 0.84 – 59.65  | 0.0704   |
|                                     | 4           | 64                          | 9                           | 14.06 | 9.80  | 1.20 – 80.03  | 0.0329   |
|                                     | 5           | 65                          | 4                           | 6.15  | 3.93  | 0.42 – 36.23  | 0.2266   |
|                                     | 6           | 40                          | 2                           | 5.00  | 3.15  | 0.27 – 36.03  | 0.3546   |
| History of the previous infestation | Yes         | 76                          | 15                          | 19.74 | 6.12  | 2.68 – 13.99  | < 0.0001 |
|                                     | No*         | 285                         | 11                          | 3.86  | -     | -             |          |
| Students’ fathers education         | Illiterate  | 4                           | 1                           | 25.00 | 5.88  | 0.53 – 65.43  | 0.1490   |
|                                     | Primary     | 29                          | 2                           | 6.90  | 1.30  | 0.25 – 6.84   | 0.7501   |
|                                     | Secondary   | 78                          | 7                           | 8.97  | 1.74  | 0.56 – 5.39   | 0.3363   |
|                                     | High school | 138                         | 10                          | 7.25  | 1.38  | 0.48 – 3.92   | 0.5453   |
|                                     | University* | 112                         | 6                           | 5.36  | -     | -             | -        |
| Students’ mothers education         | Illiterate  | 5                           | 1                           | 20.00 | 16.00 | 0.83 – 305.75 | 0.0655   |
|                                     | Primary     | 57                          | 4                           | 7.02  | 4.83  | 0.52 – 44.53  | 0.1647   |
|                                     | Secondary   | 94                          | 10                          | 10.64 | 7.61  | 0.95 – 61.06  | 0.0558   |
|                                     | High school | 140                         | 10                          | 7.14  | 4.92  | 0.61 – 39.30  | 0.1326   |
|                                     | University* | 65                          | 1                           | 1.54  | -     | -             | -        |
| Students’ family size               | 3*          | 94                          | 6                           | 6.38  | -     | -             | -        |
|                                     | 4           | 163                         | 11                          | 6.75  | 1.06  | 0.37 – 2.96   | 0.9096   |
|                                     | 5           | 90                          | 7                           | 7.78  | 1.23  | 0.39 – 3.83   | 0.7125   |
|                                     | 6           | 11                          | 2                           | 18.18 | 3.25  | 0.57 – 18.59  | 0.1835   |
|                                     | 7           | 3                           | 0                           | 0.00  | NA    | NA            | NA       |

\* Reference group. OR: Odds ratio; 95% CI: 95% confidence interval; NA: Not applicable.

(South of Iran) [21], 1.2% in the city of Pakdasht (center of the country) [22], 7.4% in the Kurdistan province 7.4 % [23], 4% in the city of Urmia [24] and 1.05% in the city of Hamedan [25]. The varied ranges of HLI prevalence in different provinces of Iran and also countries worldwide may represent infrastructural inertia, and socio-economic circumstances that might impact on health of especially school-aged children in different regions of a country or cross borders. The diversity may also stem from application of diverse diagnostic methods or recruitment of heterogeneous study samples.

Primary school-aged children are more prone to the side effects of the infestation since, it may lead to stereotyping of the children [26] hence, their social and psychological isolation with long term consequences on their mental well-being. Close contacts between children (e.g. when playing in class or yard) in schools' environment is an elemental basis for HLI dynamics. The recommended precautionary restriction of these contacts especially for infested children may diminish their self-esteem and therefore, affect their self-efficacy for social contacts. School health authorities particularly in the highly prevalent HLI regions therefore, should give a more priority to HLI and do not consider the disease just as a routine pediatric morbidity but as a disorder with potentially long-lasting mental consequences.

HLI was suggested to have association with low SES and educational level of parents in previous studies [17,27-29]. This study findings however, did not support presence of a linkage between family size and parents' education with HLI. Probably other dynamic predisposing factors for instance habitual personal or parental hygienic behavioral profile could play more influential role in HLI as ascertained in other studies [30]. Previous infestations with HLI was recognized to be a major predicting factor for recurrence of the acute

infestation. The finding was consistent with the results of earlier conducted research [17-31,32]. The association may reflect the relative importance of families' persistent inferior health status in subsequent higher chance of the members' involvement with HLI. Frequent inspection of the studied school-aged girls' hairs for HLI by health workers or parents, following the recommended times of the child bathing and their regular hair combing indicated to have protective effect against HLI in this study in accord with the observed pattern in previous research [33,34].

All efforts were made in this study to prevent bias in different stages of its implementation. Visual inspection of the students' hair and scalp without application of medical appliances (e.g. head lice comb with magnifying tool, electric head lice comb) might cause an underestimation of the HLI prevalence. Proper screening of the students' hairs and scalps for HLI requires multiple examination but due to logistic restraints only a single session inspection was performed in the research. However, the inspections were performed carefully by a health professional experienced with pediculosis, thus reducing the number of false negative diagnoses. Accuracy of the collected data via the applied questionnaire was also highly dependent on the parents and students ability to read, their awareness of head lice in the past and willingness to complete the questionnaires precisely. Despite all these methodological limitations, the study findings could be considered as an iconic depiction of grass root risk factors that might increase chance of HLI in a typical deprived community setting.

**Conclusions**

Pediculosis was observed to have association with poverty-related variables and hygiene habits in the studied Iranian elementary schools. Synchronized efforts to enhance public knowledge, periodic

**Table 2.** Personal hygiene habits among the studied school-aged children (n = 361), and association with head lice infestation in the city of Paveh, West Iran.

| Variables  |      | Number of | Number of         |      | OR   | 95% CI       | p-value  |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|--|------|-----------|-------------------|------|------|--------------|----------|--|------|-----|----|------|------|--------------|----------|------|-----|----|------|--|------|-----|----|------|------|--------------|----------|-----|-----|----|------|--|------|-----|----|-----|------|--------------|----------|-----|-----|----|------|--|-----|-----|----|-----|------|--------------|--------|
|  |      | students  | infested students | n    |      |              |          | %  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
| General frequency of bathing in a week                                       | < 2  | 51        | 15                | 29.4 | 7.90 | 3.36 - 18.60 | < 0.0001 |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|  | ≥ 2* | 310       | 11                | 3.5  |      |              |          | General frequency of hair-combing in a day                                   | < 2  | 59  | 10 | 16.9 | 3.64 | 1.56 – 8.50  | 0.0027   | ≥ 2* | 302 | 16 | 5.3  | Inspection of hairs for HLI by parents in a week                             | Yes* | 102 | 18 | 17.6 | 0.39 | 0.19 – 0.78  | 0.008    | No  | 259 | 18 | 3.1  | Inspection of hairs for HLI by health workers in a month                     | Yes* | 250 | 7  | 2.8 | 7.16 | 2.91 – 17.61 | < 0.0001 | No  | 111 | 19 | 17.1 | Students complete dependency to others in performing personal hygiene habits | Yes | 296 | 21 | 7.1 | 0.91 | -0.33 – 2.52 | 0.8660 |
| General frequency of hair-combing in a day                                   | < 2  | 59        | 10                | 16.9 | 3.64 | 1.56 – 8.50  | 0.0027   |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|  | ≥ 2* | 302       | 16                | 5.3  |      |              |          | Inspection of hairs for HLI by parents in a week                             | Yes* | 102 | 18 | 17.6 | 0.39 | 0.19 – 0.78  | 0.008    | No   | 259 | 18 | 3.1  | Inspection of hairs for HLI by health workers in a month                     | Yes* | 250 | 7  | 2.8  | 7.16 | 2.91 – 17.61 | < 0.0001 | No  | 111 | 19 | 17.1 | Students complete dependency to others in performing personal hygiene habits | Yes  | 296 | 21 | 7.1 | 0.91 | -0.33 – 2.52 | 0.8660   | No* | 65  | 5  | 7.7  |  |     |     |    |     |      |              |        |
| Inspection of hairs for HLI by parents in a week                             | Yes* | 102       | 18                | 17.6 | 0.39 | 0.19 – 0.78  | 0.008    |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|  | No   | 259       | 18                | 3.1  |      |              |          | Inspection of hairs for HLI by health workers in a month                     | Yes* | 250 | 7  | 2.8  | 7.16 | 2.91 – 17.61 | < 0.0001 | No   | 111 | 19 | 17.1 | Students complete dependency to others in performing personal hygiene habits | Yes  | 296 | 21 | 7.1  | 0.91 | -0.33 – 2.52 | 0.8660   | No* | 65  | 5  | 7.7  |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
| Inspection of hairs for HLI by health workers in a month                     | Yes* | 250       | 7                 | 2.8  | 7.16 | 2.91 – 17.61 | < 0.0001 |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|  | No   | 111       | 19                | 17.1 |      |              |          | Students complete dependency to others in performing personal hygiene habits | Yes  | 296 | 21 | 7.1  | 0.91 | -0.33 – 2.52 | 0.8660   | No*  | 65  | 5  | 7.7  |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
| Students complete dependency to others in performing personal hygiene habits | Yes  | 296       | 21                | 7.1  | 0.91 | -0.33 – 2.52 | 0.8660   |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |
|  | No*  | 65        | 5                 | 7.7  |      |              |          |  |      |     |    |      |      |              |          |      |     |    |      |  |      |     |    |      |      |              |          |     |     |    |      |  |      |     |    |     |      |              |          |     |     |    |      |  |     |     |    |     |      |              |        |

\* Reference group. OR: Odds ratio; 95% CI: 95% confidence interval.

examination of school-aged children for pediculosis, and proper treatment of infested patients are needed to control the disease in the typical government-run elementary schools of the country. The prevailing chain of recurrent HLI must be very strictly investigated and evidence-informed interventions must be followed to ensure all but especially disfranchised school-aged children's health and productivity. The applied strategies in low and middle income countries was suggested to focus mainly on low cost family-based and school-based initiatives for maximum effectiveness.

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