

Prevalence and Risk Factors of Pediculosis in Different Primary School in Zakho City, Iraq

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Abstract

The head louse (*Pediculus humanus capitis*) is a common, wingless, obligate blood-sucking ectoparasite belonging to the order Phthiraptera, which is a specific parasite of humans with worldwide medical importance. This study was conducted to estimate the prevalence of head lice and its associated factors among primary school pupils in six selected schools in Zakho City. A total of 215 pupils (80 boys and 135 girls) were examined from the first to the sixth stages, aged 6 to 14 years, during October 2024 to March 2025. The results revealed an overall infestation prevalence of 22.32% (48/215), with a significantly higher rate among females than males (30.37% vs 8.75%). The age of 8 years showed the highest nonsignificant infestation rate with pediculosis; thereafter, the rate declined nonsignificantly with increasing age. The infestation rate among long-haired pupils was 29% higher than among short-haired pupils (16.52%). The student using the shared combs has a higher infestation rates than using the personal comb. This study revealed a significant relationship ($P < 0.05$) between gender, hair length, growth stage, and school location and head louse infestation. In contrast, no significant relationships ($P > 0.05$) were observed for age, hair washing, using a personal comb, and head lice infestation. From this study, we conclude that there is a high prevalence of head lice among pupils in primary schools, which necessitates the application of preventive measures, including personal hygiene and cleanliness, frequent hair washing, and not sharing combs between students or family members.

1. Introduction

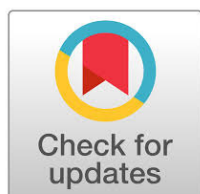
Pediculus humanus capitis, commonly known as head lice, is a causative agent of pediculosis, a blood-feeding ectoparasite, and one of the most widespread parasitic infestations globally [1]. The relationship between humans and head lice dates back approximately 10,000 years [2].

Despite advancements in hygiene and sanitation worldwide, pediculosis remains prevalent in both developed and developing countries, particularly among school-aged children who frequently interact in close contact [3]. Crowded environments such as schools and refugee camps provide ideal conditions for the spread of head louse [4].

Head lice infestation is most commonly observed in children aged 3 to 13 years [5]. The primary symptom is

intense scalp itching, which can lead to secondary bacterial infections entering through louse bites [6].

According to the World Health Organization [7], these diseases can be caused by parasites, bacteria, or viruses, and body lice are known vectors for transmitting typhus and louse-borne relapsing fever. The significant prevalence of pediculosis in affected regions highlights the need for effective, safe, and environmentally friendly control measures. One promising control approach is the use of phyto-nanoparticles, which are synthesized through green methods that are eco-friendly, non-toxic, and widely available. Nanoparticles, ranging in size from 1 to 100 nanometers, have shown potential in controlling lice infestations without harmful side effects [8,9]. Numerous studies have been performed in Kurdistan Region and Iraq on this aspect



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such as Ali and Hama [10] in Sulaimani, Amin et al. [11] in Kalar, Alberfkani and Mero [12] in Zakho, Hama et al. [13] in Sulaimani, Al-Barrak [14] in Baghdad, AL-Doody et al. [15] in Erbil, and Hama-Karim et al. [16] in Sulaimani. They recorded rates of 1.12%, 14.43%, 36.2%, 8.3%, 9%, 21.27%, and 9.16%, respectively. The present study aimed to determine the infestation rate of head lice among primary schools' children of both genders and different ages and its association with some risk factors in Zakho city.

2. Materials and Methods

2.1. Sample collection

A cross-sectional study was conducted from October 2024 to March 2025 and involved children of both genders and various ages (6 to 14 years) from different basic primary schools located in areas with varying socioeconomic standards in Zakho city. The schools selected for this study were chosen randomly and included: the Shokh, Khameter, Bedari, Bakerman, Bishkeften, and Siban. The study involved a total of 215 pupils (80 boys and 135 girls) from grades 1 to 6. A questionnaire was designed to include variables about the children, such as age, gender, hair type, hair-washing intervals, use of a personal comb, etc. All children hair, scalp, areas around the ears, and the base of the neck were inspected for the presence of head lice and its stages such as nits and nymphs using a V-Comb machine for collection [14,17]. The adult lice and other stages attached to each child's hair were removed and placed in a container with 70% ethanol as a preservative. Each container was labeled with the required information, and the collected containers were transferred to the laboratory of Biology Department, Science College, Zakho University for processing. Later, they were examined under the dissecting and light microscopes for the identification of the adult and other lice stages, according to Service [18].

2.2. Inclusion and Exclusion Criteria

All pupils who were keen to provide informed consent and agreed to provide a specimen were included in this work. On the other hand, this research excluded pupils who refused to provide specimens or did not sign the informed consent form.

2.3. Statistical Analyses

The obtained epidemiological data were analyzed using SPSS (version 25), and the Chi-square (X^2) test was used to assess the probability value. P value less than 0.05 was considered statistically significant.

3. Results and Discussion

Pediculosis (head lice) is one of the most prevalent infestations of public health concerns globally. Furthermore, lice

are among the most significant obligate ectoparasites of humans, and infestation rates vary according to geographical location and socioeconomic level [19,20]. Therefore, it is necessary to compare the current study's findings with earlier data on head lice infestation among primary school students from both local and international sources. The current study reports an overall head lice infestation rate of 22.33% (48/215) among enrolled pupils (Table 1). Similar results of the head lice infestation among essential school pupils were recorded in Tikrit (22.89%), Al-Najaf (22.9%), Mosul (22.3%), and Erbil (25.5%) by Al-Alousi and Tawfeeq [21], Al-Zayyadi [22], Sulaiman et al. [23], and Al-Marjan et al. [24]. On the other hand, lower rates were recorded among school children, and among refugees in Sulaimani (1.12% and 8.3%) [10,13], in Baghdad 9% [14]. While much higher rates of 36.2% and 38.6% than the current rate were reported in Zakho and Baquba cities [12,25], respectively. Several risk factors contribute to the variation in the rate of head lice infestation globally, including climate, living conditions, and personal socioeconomic factors [20]. Lice infestation is more common among children due to direct contact, environmental conditions, poor personal hygiene, and the continuous sharing of hair combs and other hair items [26]. Also, other factors influence human lice infestation, including the genetic background of both the parasite and the host, the host's immune response, and nutritional status. In addition, anti-coagulant and immunomodulatory proteins in lice saliva help the parasite feed and evade host defenses, affecting infestation rates [27,28].

The results also showed a highly significant difference ($P < 0.000$) in infestation rate between females and males (30.37 % vs 8.75 %), as shown in Table 1. Similarly, previous studies in Kurdistan Region and Iraq reported higher infestation rates among females, Ali and Hama [10]; Hama et al. [13], and Hama-Karim et al. [16] in Sulaimani, Al-Barrak [14] in Baghdad, and Al-Marjan [29] in Erbil. The higher rate of infestation among females might be attributed to the behavioral patterns between boys and girls, such as girls' clothes and closer physical contact, which facilitates transmission. Moreover, girls generally have longer hair than boys, which requires more frequent combing. Moreover, lice are more adapted to females, since the hair is a good place for breeding; head lice are long and covered by scarfs.

Results demonstrate the highest rate (33.33%) at age 8, then the rate declined with increasing age (Table 2), but these differences were not statistically significant ($P < 0.665$). Few studies have addressed the relationship between age and infestation rate; studies somewhat in line with ours are those performed in Baghdad [14,30], which reported the highest rates among ages 8–10 years and 6–7 years at 18.7% and 10.3%, respectively. In Sulaimani¹³, the highest prevalence of head lice infestation was reported among 8–10-year-olds at 44.41%. While the present study results disagree with those of Ali and Hama [10] in Sulaimani, who reported the highest infestation rates (1.44%) among children aged 1–5 years, and Amin et al. [11] in Kalar, who observed the highest rate of infestation

Table (1): Prevalence of pediculosis among primary school children in Zakho city according to gender.

| Gender | No. of examined | No. of non-infested | No. of infested | Prevalence of pediculosis (%) |
|--------|-----------------|---------------------|-----------------|-------------------------------|
| Male | 80 | 73 | 7 | 8.75 |
| Female | 135 | 94 | 41 | 30.37 |
| Total | 215 | 167 | 48 | 22.32 |

χ^2 : 13.540 $P < 0.000$.

Table (2): Prevalence of pediculosis among primary school children in Zakho city according to their ages.

| Age (years) | No. of examined | No. of non-infested | No. of infested | % of pediculosis |
|-------------|-----------------|---------------------|-----------------|------------------|
| 6 | 35 | 28 | 7 | 20 |
| 7 | 42 | 33 | 9 | 21.42 |
| 8 | 36 | 24 | 12 | 33.33 |
| 9 | 27 | 21 | 6 | 22.22 |
| 10 | 22 | 18 | 4 | 18.18 |
| 11-14 | 53 | 43 | 10 | 18.86 |
| Total | 215 | 167 | 48 | 22.32 |

χ^2 : 3.228 $P < 0.665$.

(23.35%) in children aged 10–11 years. There are several important points related to age in infestations to focus on. Usually, older ages have more opportunities to make contact with other children for play and to stay outside the home for longer periods than younger ages; therefore, contact with children can increase the risk of acquiring infestation from others [29].

Regarding the rate of infestation among pupils in schools in areas differing in socioeconomic level and during the months when lice are most prevalent, which were selected.

Regarding hair length, the examined pupils were divided into two groups: long hair (100) and short hair (115). Results revealed infestation rates of 29% among long hairs and 16.52% among short hairs, with a significant difference ($P < 0.28$) between the groups (Table 3). Previous studies performed in Kurdistan, Iraq, and other countries also reported higher infestation rates with head lice among individuals with long hair in comparison to those with short hair such as 12.62% vs. 5.24% and 16.67% vs. 1.99% [13,16], respectively, in Sulaimani province, 11.5% vs. 6.3% [14] in Baghdad, 33.2% vs. 19.5% [24] in Erbil, 25% vs. 44% [31] in Mexico, and 27.3% vs. 9.3% [32] in Tunisia. The higher infestation with pediculosis among individuals with long hair may be due to the reason that long hair is more suitable place for lice to replicate, feed, and secure them. On the other hand, the present result contradicts those of Ali and Hama [10] in Sulaimani, who stated that short hair had a higher infestation rate with head lice than long hair (1.2% and 0.6%), respectively.

According to using own comb or shared combs. The results revealed a slightly higher infestation rate in the second group compared to the first (22.75% vs 21.42%), as

indicated in Table 3. Sharing combs with others might facilitate the direct transmission of lice, nymphs, or nits from one individual to another, especially if the spaces between comb teeth are narrow. Similar results were reported in other studies performed in Kurdistan and other part of Iraq including Ali and Hama [10] in Sulaimani, Amin et al. [11] in Kalar, Al-Marjan et al. [24] in Erbil, and Al-Barrak¹⁴ in Baghdad. On the other hand, the present results disagree with Dagne et al. [33] in Ethiopia, who reported the highest rate in students' personal comb than in the sharing combs (53.5% vs 46.5%).

Regarding hair washing, among the enrolled students, 91 of them wash their hair daily while 124 it once a week. Results showed nonsignificantly ($P < 0.153$) higher infestation rate among those who wash their hair once a week in comparison to daily washing (25.80% vs 17.58%; Table 3). These results are consistent with the research conducted in Sulaimani by Ali and Hama [10], who reported higher infestation among students who washed their hair only once per week than among those who washed it daily (1.37% vs 0.54%). While the present result conflicts with other studies conducted in Iraq such as Hama et al. [13] in Sulaimani, Al-Barrak [14] in Baghdad, and Al-Marjan et al. [24] in Erbil, all of them reported higher infestation of head lice among individuals who wash their hair daily at rates of 9.89%, 12.5%, and 41.4%, respectively. They attributed it to the fact that daily hair washing during winter, the season of school attendance, obliges the girls to wear scarves on their hair after washing; this will create a hot and humid environment, which facilitates the growth and reproduction of head lice, as also confirmed by Al-Marjan et al. [34].

According to the lice growth stages detected among primary school's pupils. The results revealed higher

Table (3): Prevalence of pediculosis among pupils and its association with some factors in Zakho city.

| Characteristic (factors) | | No. examined | No. noninfested | No. infested | % Prevalence of pediculosis | Chi-Square | P value |
|--------------------------|-------|--------------|-----------------|--------------|-----------------------------|------------|---------|
| Length of hair | Short | 115 | 96 | 19 | 16.52% | 4.803 | 0.028 |
| | Long | 100 | 71 | 29 | 29% | | |
| Personal comb | Yes | 70 | 55 | 15 | 21.42% | 0.048 | 0.826 |
| | No | 145 | 112 | 33 | 22.75% | | |
| Washing daily | Yes | 91 | 75 | 16 | 17.58% | 2.047 | 0.153 |
| | No | 124 | 92 | 32 | 25.80% | | |

Table (4): The parasites stages on the infested head of children in the school of the Zakho city.

| Growth stages | No. of examined | No. of infested | Prevalence of pediculosis (%) |
|---------------|-----------------|-----------------|-------------------------------|
| Nits (egg) | 215 | 10 | 4.65 |
| Adult | 215 | 12 | 5.58 |
| Both | 215 | 26 | 12.09 |

$\chi^2: 9.500 P < 0.009$.

infestation with both adults and nits than with either alone, at rates of 12.09%, 5.58%, and 4.65%, respectively, with highly significant differences. Statistical analysis shows that there was a highly significant difference ($P < 0.009$) between them (Table 4) and Figure 1 (A and B). The study conducted by Al-Barrak [14] among primary school children in Baghdad, recorded the highest infestation rate with adult stage followed by nymphs, more than one stage and nits (8.7%, 4.6%, 4.3%, and 3%), respectively.

Table 5 shows the head lice infestation rate among pupils from different schools involved in this study. The study included 6 schools situated in various parts of Zakho City, selected randomly to include students of both genders and differing socioeconomic conditions. The investigation showed that the highest infestation was at Bedari Basic School, followed by Bishkeften and Shokh, with infestation rates of 40%, 34.28%, and 31.42%, respectively.

In contrast, the lower infestation rate was recorded at Bakerman Basic School and Siban Basic School, at 6.66% and 5.55%, respectively. Statistical analysis revealed a highly significant difference ($P < 0.000$) in infestation rates between these schools.

The global rate of head lice infestation (overall infestation rate) varies by geographical region [20]. Changes in social structure, demography, social soundness, relocation, the improvement of the family health care system in some countries, economic and military instability, and a high contact between rural and urban areas in some regions throughout the world, all these factors have a strong relationship in the fluctuation of the rate of infestation by the head lice [19,35].

4. Conclusion

The results obtained from the current study showed a high overall rate of head lice infestation among primary school pupils in Zakho city. Females aged 8 years, those with long hair, those sharing combs, and those with infrequent hair washing showed high lice infestation rates. To minimize this rate, it is advisable to implement preventive strategies through the introduction of health education programs in schools and the community. Improving living and health conditions and implementing sanitary and hygienic measures will improve the situation in schools and across the population.

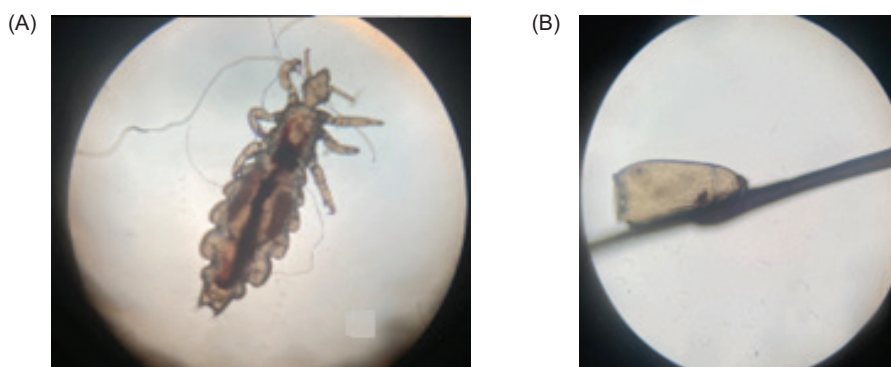


Figure (1): Morphological views of the different stages of head lice *P. humanus capitis*. (A) Adult head lice, (B) Egg (Nits) of head lice.

Table (5): Overall prevalence of the head lice infestation among selected primary school in Zakho city.

| Name of school | No. of examined | No. of infested | Prevalence of pediculosis (%) |
|-------------------------|-----------------|-----------------|-------------------------------|
| Shokh Basic School | 35 | 11 | 31.42 |
| Khameter Basic School | 39 | 5 | 12.82 |
| Bedari Basic School | 40 | 16 | 40 |
| Bakerman Basic School | 30 | 2 | 6.66 |
| Bishkeften Basic School | 35 | 12 | 34.28 |
| Siban Basic School | 36 | 2 | 5.55 |
| Total | 215 | 48 | 22.32 |

χ^2 : 23.877 $P < 0.000$.

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Data Availability

The data used in this study are available on request from the corresponding author.

Conflict of Interest

There is no conflict of interest in this study.

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