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Epidemiological Assessment of Head Lice Among Primary School Children in East Duhok, Iraq

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ABSTRACT

Background and Objective: Pediculosis is a common ectoparasitic condition affecting humans, mainly children, globally. The objective of this research was to evaluate the prevalence of head lice infestation and explore the contributing risk factors among primary school children in Duhok City, Iraq. **Methodology:** Overall, 460 children of age group 6–7 years during the period from October 2023 to March 2024 were collected from 12 schools in the east part of Duhok City. All children were randomly examined for the presence of any stage of *Pediculus capitis*. The schools were selected using multistage sampling methods. **Results:** Overall, 6.3% of the schoolchildren were infested. Among females, the prevalence was higher (8.1%) compared to males (3.1%); it was a statistically significant association at ($P<0.05$). The current study revealed that the prevalence rate of pediculosis among girls was associated with several variables as follows: hair length, hair tying, wearing a head veil, and experiencing itching: 59.6% had long hair and 40.4% had short hair, while 44.3% tied their hair and 55.7% did not. Only 1.5% wore a head veil, and 10.0% reported experiencing itching. Head lice remain a health problem among schoolchildren. **Conclusion:** The prevalence of pediculosis can be considerably decreased by raising awareness among teachers and family members, providing them with more training, and enhancing personal health standards.

INTRODUCTION

Head lice, or *Pediculus humanus capitis*, is a sucking insect that inhabits the human's hair and scalp and is the causative agent of the disease pediculosis in humans (Mohammed, 2012). Humans are infested with head lice by direct contact (head-to-head) with infested people (Mohammed, 2012; Feldmeier, 2012). Humans are usually infested by three common types of sucking lice, including head lice (*P.h. capitis*), pubic lice (*Pthirus pubis*), and body lice (*P.h. capitis*), and head lice are considered the common type (Roberts, 2002; Delie *et al.,* 2024). *P.h. capitis*, till now, remains a health problem globally, especially in homeless regions, refugee camps, kindergartens, and crowded primary school with children aged between 1 and 13 years old (Yousefi *et al.,* 2012; Moosazadeh *et al.,* 2015; Abbasi *et al.,* 2023).

P. h. capitis is an insect located within the kingdom Animalia, class Insecta, order Phthiraptera, and suborder Anoplura (sucking lice) (Burgess *et al.,* 2004). Sucking lice are wingless and small-sized insects that range between 2 and 4 mm and suck human blood as feed (Parison *et al.,* 2013).

The primary means of lice transmission is direct contact with infected individuals. Furthermore, touching contaminated pillows, caps, combs, or brushes might spread the illness indirectly (Moosazadeh *et al.,* 2015; Nejati *et al.,* 2018).

Pediculosis has several effects on the child's health and behavior, such as itching of the scalp, allergic reactions, and disturbed child sleeping, and impacts the psychology of children because they feel shame and anger from society when they are infested with head lice (Gholamnia Shirvani *et al.,* 2013; Abbasi *et al.,* 2023). Children in primary school, usually in the age range of 6–12 years, are more susceptible to people infested with head lice. Even with attempts to eliminate the number of primary school students who become infested with head lice, 19% of students globally are infested (Moosazadeh *et al.,* 2015).

Across the world, lice infections are common; however, in poor nations, a broad variety of pediculosis cases have been reported (Salehi *et al.,* 2014). Iran has a 7.6% (Hatam-Nahavandi *et al.,* 2020), Syria has a 14.3% (Ismail *et al.,* 2018), Turkey has a 13.1% (Gulgun *et al.,* 2013), and Jordan has a 20.4% (Khamaiseh, 2018) frequency of head lice, according to epidemiological research conducted in schools around the Middle East. Iraqi primary school students' head lice infestation rates range from 3.6% in Baghdad (Al-Mendalawi and Ibrahim, 2012) to 20.08% in Kirkuk (Suleiman and Magar, 2014). *Pediculus capitis* infestations affected schoolchildren in the Kurdistan Region of Iraq at a rate of about 14% overall (Abdulla, 2015; Salih *et al.,* 2017; Obaid, 2018). Many factors, such as the frequency of head-to-head interactions, diagnostic techniques, pesticide resistance, school head lice policies (no-nit policy), and general head lice awareness, could be responsible for the variation in infection rates (El-Sayed *et al.,* 2017). Therefore, this study aimed to determine the prevalence of pediculosis among school-aged children and its related risk factors in Duhok City, Iraq.

MATERIALS AND METHODS

1.Study Design and Sample Collection:

A cross-sectional descriptive study was conducted among primary school children in Duhok City, Iraq, from October 2023 to March 2024 (spring and autumn seasons). Samples were collected from 12 schools from the east part of Duhok City, because Duhok City is divided into two parts: east and west.

2.Students and Examination:

All children were randomly examined for the presence of any stage of Pediculus capitis. The schools were selected using multistage sampling methods. The study was conducted in randomly selected primary schools to test the pupils from first and second grade. In general, 460 students (298 females and 162 males) were selected in the age group (6-7); they were examined individually for all stages of the head lice life cycle, such as egg/adult, as seen in Figure 1. In this process, a handled magnifying lens and, to disperse hair, thin wooden sticks were used to examine the presence of lice stages. The infestation was indicated when there were adults and nits (eggs). The hair of each child was examined for at least 2-3 minutes, depending on hair length. Examined students were grouped according to their gender and age.

Fig. 1. Eggs of *Pediculus humanus capitis*

Statistical Analysis:

SPSS software was used with the chi-square and Fisher's exact tests to study the significant relationship between lice infestation prevalence and the independent variables. Statistical significance was set at $P < 0.05$.

RESULTS

The initial part of the results should focus on demographics and general prevalence. Out of 460 primary school children, there were 298 (64.8%) girls, and 162 (12.4%) boys in the age group (6 and 7 years old). Overall, 6.3% of the children were infested with lice. Among females, the prevalence was higher at 8.1%, compared to males at 3.1%, as shown in Table 1.

Table 1. Lice infestation among primary school children in Duhok City, Iraq, categorized by age and gender.

Characteristics		Frequency	%	Significant at P Value <0.05
Gender	Female	298	64.8	
	Male	162	35.2	
Age	6 years	57	12.4	
	7 Year	403	87.6	
Total		460	100.0	

Gender	Lice		Total No. %	Chi-Square test	Sig.< 0.05	Odds Ratio	95% Confidence Interval	
	Yes %	No %					Lower	Upper
Female	24 (8.1)	274 (91.9)	298 (64.8)	4.384	0.036	2.750	1.029	7.352
Male	5(3.1)	157 (96.9)	162 (35.2)					
Total	29 (6.3)	431 (93.7)	460 (100.0)					

Age	Lice		Total No. %	Fisher's Exact Test	Significance< 0.05
	Yes %	No %			
6 Years	0 (0.0)	57 (100.0)	57 (12.4)		0.037
7 Years	29 (7.2)	374 (92.8)	403 (87.6)		
Total	29 (6.3)	431 (93.7)	460 (100.0)		

Among 6-year-old children, none were infested with lice, while among 7-year-olds, the prevalence was 7.2%. A Fisher's exact test was conducted to assess whether there was a significant association between age and lice infestation. The test yielded a p-value of 0.037, indicating a statistically significant association at the 0.05 significance level. This suggests that there was a difference in the prevalence of lice infestation between these age groups. As seen in Table 1.

2. Hair Characteristics and Risk Factors, May Be Organized into Three Distinct Parts:

A. Hair Length:

It presents data on lice infestation by hair length. Among children with short hair, the prevalence was 3.2%, while among those with long hair, it was 8.4%. This suggests that there was a difference in the prevalence of lice infestation between children with short and long hair. The significance level (p-value) of 0.025 indicates that there was a statistically significant association between hair length and lice infestation among primary school children, as it falls below the conventional threshold of 0.05, as seen in Table 2.

B. Hair Tying:

Among children with their hair tied, the prevalence was 9.8%, while among those with their hair untied, it was 3.5%. This suggests that there was a difference in the prevalence of lice infestation between children who tie their hair and those who do not. In this case, the odds of lice infestation are 2.983 times higher among children who tie their hair compared to those who do not, as in Table 2.

C. Head Veil Usage:

Among children who wore a head veil, the prevalence was 14.3%, while among those who did not, it was 6.2%. This suggests that there is no clear difference in the prevalence of lice infestation between children who wore a head veil and those who did not, based on this data, as seen in Table 2.

D. Itching Symptoms:

Among children who experienced itching, the prevalence of lice infestation was much higher at 43.5%, compared to only 2.2% among those who did not report itching. This suggests that there was a substantial difference in the prevalence of lice infestation between children who experienced itching and those who did not, as seen in Table 2.

Table 2: Frequencies and percentages for various characteristics related to hair length, hair tying, wearing a head veil, and, hair tired, and experiencing itching,

Characteristics		Frequency	%	Significant at P Value <0.05
Hair Length	Short	186	40.4	
	Long	274	59.6	
Tied Hair	Yes	204	44.3	
	No	256	55.7	
Head veil	Yes	7	1.5	
	No	453	98.5	
Itching	Yes	46	10.0	
	No	414	90.0	
Total		460	100.0	
Lice infestation	Yes	29		Significant at P Value <0.05
	No	431		
Total	460	100.0		

Hair Length	Lice		Total No. %	Chi-Square	Sig. <0.05	Odds Ratio	95% Confidence Interval	
	Yes %	No %					Lower	Upper
Short	6 (3.2)	180 (96.8)	186 (40.4)	5.01	0.025	0.364	0.145	0.912
Long	23 (8.4)	251 (91.6)	274 (59.6)					
Total	29 (6.3)	431 (93.7)	460 (100.0)					

Tied Hair	Lice		Total No. %	Chi-Square	Sig. < 0.05	Odds Ratio	95% Confidence Interval	
	Yes %	No %					Lower	Upper
yes	20(9.8)	184 (90.2)	184(90.2)	7.6	0.006	0.983	1.328	6.703
No	9 (3.5)	247 (96.5)	247(96.5)					
Total	29(6.3)	431 (93.7)	431 (93.7)					

Head veil	Lice		Total No. %	Fisher's Exact Test		95% Confidence Interval	
	Yes %	No %		Sig.< 0.05	Odds Ratio	Lower	Upper
Yes	1(14.3)	6 (85.7)	7 (1.5)	0.368	2.530	0.294	21.75
No	28 (6.2)	425 (93.8)	453 (98.5)				
Total	29 (6.3)	431 (93.7)	460(100.0)				

Itching	Lice		Total No. %	Fisher's Exact Test		95% Confidence Interval	
	Yes %	No %		Sig.< 0.05	Odds Ratio	Lower	Upper
Yes	20 (43.5)	26 (56.5)	46 (10.0)	< 0.001	34.6	14.3	83.5
No	9 (2.2)	405 (97.8)	414 (90.0)				
Total	29 (6.3)	431 (93.7)	460(100.0)				

DISCUSSION

Millions of individuals globally, especially in underdeveloped nations like Iraq, are impacted by the public health issue of human pediculosis. Head lice infestations have serious negative effects on a person's mental and physical health as well as those of their friends and family (Frankowski *et al.,* 2002; Fu *et al.,* 2022). Around the world, infestation with lice is a serious public health issue that primary school pupils are more prone to, especially in developing nations (Dagne *et al.,* 2019). Children between the ages of 5 and 13 are typically affected (Davarpanah e*t al.,* 2013; Rukke *et al.,* 2014).

The findings of the current study showed that the prevalence rate of pediculosis was higher among females. The presence of this high rate of infestation among schoolchildren of all ages (Burgess, 2004; Abbasi e*t al.,* 2023) is related to crowding in school, poor personal hygiene, sitting near each other, sharing hair combs, sharing head coverings, and wearing head hats—all these are suitable factors for pediculosis to transmit widely among children, as the disease is transmitted by direct contact (head-to-head) (Saleem *and* Zefenkey, 2023; Ismael and Omer, 2021). Alberfkani and Mero (2020) reported a high rate of head lice in female girls in Zakho City, Iraq. Regarding head lice, the rate of head lice (6.3%) among primary school pupils in Duhok City was similar to that reported by several previous studies, such as those by Abdullah (2015) and Ali and Hama (2018). On the other hand, a high rate (42.7%) was reported by Kadir *et al.* (2017), who determined the prevalence of head lice among secondary school girls in Kirkuk City, Iraq. The present result disagrees with Vahabi *et al.* (2012), who reported children aged 10–11 years were more prevalent than children aged 6 and 7 years.

The present data found there was a significant relation between head lice and gender, and a higher rate was recorded in girls (8.1%) than in boys (3.1%). This rate is close to the rate reported by Alberfkani and Mero (2020). This disease is transmitted by close head-to-head contact, and this close is more common in boys than in girls. Girls have long and thick hair that leads to close head contact and provides a good shelter for the growth and reproduction of lice. All these facilitate the spread of pediculosis and explain why the rate of infestation is higher in girls than boys (Ahmed e*t al.,* 2022; Muhammad *et al.,* 2010). This finding is in line with Hama-Karim *et al*. (2022); they proved that the frequency was higher in girls than in boys among primary schools in Sulaimani City, Iraq. The same rate was reported by a study done in Azmir, Turkey, which documented that girls were three times more susceptible to infestation with lice than boys (Karakus *et al.,* 2014). Rassami and Soonwera (2012) also reported that girls were more infested with head lice than boys.

Moreover, regarding hair length, there was a statistically significant association between hair length and lice infestation among primary school children, and girls with long hair were more prevalent than those with short hair. This is significant, because long hair is difficult to wash compared to short hair. This finding agrees with findings recorded by some researchers in different countries in West Asia (AlBashtawy and Hasna, 2012; Tappeh *et al.,* 2012; Değerli *et al.,* 2013; Nejati *et al.,* 2018). Additionally, the rate of infestation was higher in girls who wore a head veil (14.3%) than those who did not (6.2%). When girls wear evil heads that provide a good environment like humidity and temperature for lice growth and development, this is a reason for reporting a high rate of infestation in girls. Saleh *et al.* (2014) support the present result that the prevalence is higher in girls who wore a head veil than those who don't. Finally, the prevalence of lice infestation was much higher in children who had a history of itching (43.5%), compared to those who did not report itching (2.2%).

The difference in head lice frequency between boys and girls is probably due to several factors, such as the fact that female hair is a suitable habitat for head lice and that girls tend to have more intimate, prolonged, and close head contacts in small groups (Yousefi *et al.,* 2012; Faiza *et al.,* 2018; Ismael *et al.,* 2025). While numerous studies have proposed that female pediculosis may also be caused by long hair, the current study found no significant correlation between pediculosis and long hair (Saghafipour *et al.,* 2017).

CONCLUSION

This study found that pediculosis is moderately prevalent in primary school

children and girls in Duhok City, Iraq, and this is a public health problem and societal problem impacting primary school children. Efficient and lasting strategies need to be created to reduce the prevalence of head lice infestation in primary school children, with particular attention given to girls and children who have previously experienced head lice infestations.

Declarations:

Ethical Approval: The study was approved by the General Directorate of Health in Duhok city (Reference No. 131222023-11-17).

Conflict of interest: There is no conflict of interest in this study.

Availability of Data and Materials: The data used in this study are available on request from the corresponding author.

Authors Contributions: All authors made substantial contributions to this article. SS. Ismael, B.D. Ahmed, Nafal J. S. Barwary, and Bassim S. A. Sulivany conceived and designed the work. Hassan A. Khodher, Muhaimn F. Nori, Nabaa H. Obaidullah, and Sidra A. Agha collected the samples and data. B.D. Ahmed performed the analysis and wrote the first draft of the manuscript. SS. Ismael revised the analyzed data and reviewed the manuscript. Both authors have read and agreed to the published version of this manuscript.

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