



Epidemiology of Head Lice (*Pediculus humanus capitis*) Among Primary Schoolchildren in Misurata, Libya

Randa Alsalhi and Enas Habouba

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July 3, 2024

Epidemiology of Head Lice (*Pediculus humanus capitis*) among Primary Schoolchildren in Misurata, Libya

Randa Mohamed Alsalhi, Enas Fathi Habouba
Department of Epidemiology and Infection Control, Faculty of Health Sciences
Misurata University, Misurata, Libya

Keywords: Epidemiological, Misurata, *Pediculosis capitis*, Prevalence, Primary school, Schoolchildren.

Abstract

Infestation of head lice (*Pediculus humanus capitis*) is a common ectoparasitic infection in schoolchildren, causing a public health problem, which is neglected in Libya. The study aimed to conduct an epidemiological statistical study of the prevalence of pediculosis capitis infestation among primary schoolchildren in Misurata City and to determine risk factors associated with the infestation. The study was a cross-sectional descriptive study; it was conducted from March to May 2023. 1006 primary schoolchildren were selected randomly and screened for head lice by visual scalp examination. A questionnaire was used to collect data on sociodemographic status. Statistical analysis was conducted using the SPSS software package. The chi-square test was used to assess the statistical significance. This paper's Results showed Head lice infestation rate was 12.8%, it was higher in girls (18.9%) than in boys (5.0%) and it was higher in public schools (13.6%) than in private schools (8.2%). The infestation rate among schools ranged from 6.6% to 22.7%. There was a significant association between pediculosis infestation and genders ($P=0.000$), school grade ($P=0.014$), covered hair ($P=0.000$), hair softness ($P=0.001$), hair length ($P=0.016$), mother's job ($P=0.000$), father's lack job ($P=0.015$), place of residence ($P=0.044$), history of head lice infestation ($P=0.000$), and no significant difference to nationality, thick hair, presence of siblings in the same school, family size. In Conclusion Head lice infestation is a health problem in primary school girls of Misurata. Providing proper educational programs about pediculosis and prevention and improvement of socioeconomic status can be useful in reducing head lice infestation.

Introduction

Human louse infestation (Pediculosis) is a common disease that can be caused by three types of human parasites: head lice (*Pediculus humanus capitis*), body lice (*Pediculus humanus humanus*), and pubic lice (*Phthirus pubis*)¹. De Geer, in 1767 first named the head louse as *Pediculus humanus capitis*². The human head lice are permanent, obligatory ectoparasite, feed only on human blood³. Stated that head lice only live on the human head and do not live on other parts of the body⁴. Lice do not have wings⁵, and cannot jump^{6,7}, and they move by using claw-like legs to move from one hair to another⁸. They are readily transmitted by direct hair-to-hair contact, especially in crowded conditions⁹. *Pediculosis capitis* also can be transferred by clothing, hats, hairbrushes, combs, towels, brushes, bedding, cushioning, etc¹⁰. Head lice infestation is characterized by itching¹¹, especially in the backsides of the scalp, skin irritation, and loss of sleep, sometimes accompanied by swelling of the lymph nodes. In case of neglect, the infestation is often mixed with secondary impetigo¹². Pediculosis can spread rapidly and take on an epidemic dimension if left

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untreated. The prevalence of head lice is very high, and primary schoolchildren are considered more vulnerable to head lice infestation, due to the immaturity of their immune systems and poor adaptation¹³. The Centers for Disease Control and Prevention (CDC) in 2016 stated the head lice infestation rate is highest in children from 3 to 11 years¹⁴, and previous studies have shown that the highest prevalence rate of head lice infestation occurs among schoolchildren between 5-13 years¹⁵, females showing a higher rate than males, compared to boys, girls are around twice infected by head lice¹⁶. Head lice infestation has been considered a major health problem not only in poor countries but also in developed and industrialized countries¹⁷. According to the National Pediculosis Association of the USA which defines head lice infestation rate of more than 5% been considered to be an epidemic^{18,19}, the surveys described that 35% of children are infected in Malaysia²⁰, 26.6% in Jordan²¹ and 14.3% in Syria²². In Korea 58.9% in rural areas and 14.4% in urban areas²³, 35% in Brazil²⁴, and Indonesia, it is from 29.3% to 88.9%²⁵.

Pediculosis is neglected in Libya several years ago. However, a survey conducted in Benghazi city and the results showed that 88% of girls and 67% of boys have been infested by Pediculosis²⁶, in addition, survey in the western region of Benghazi, the pediculosis infestation rate was 26.3%. The prevalence of pediculosis in girls was 41.8%, while 10.2% in boys with highly statistically significant²⁷, 21.9% in Houn City¹, and 38.6% in Sebha significantly lower in boys than in girls²⁸. Little is known about the epidemiology of head lice infestation in schoolchildren in Misurata. Therefore, this study aims to determine the prevalence of head lice among some primary schoolchildren in Misurata, Libya. and determine the risk factors associated with head lice infestation among this age group. Finally, help reduce the spread of head lice in the study area.

Materials and methods:

Study design: This study was designed as a descriptive study to investigate the epidemiology of head lice infestation among primary schoolchildren in Misurata.

Field of the study (Location): Random samples from primary schoolchildren in Misurata City, Libya, were used. Misurata is located in northwestern Libya, situated 187 km (116 mi) to the east of Tripoli and 825 km (513 mi) west of Benghazi on the Mediterranean coast near Cape Misurata.

Study population: 1006 primary schoolchildren (441 boys and 565 girls) were selected from 4 different schools. Their ages ranged from 6 to 12 years. They were examined personally, by visually clinical examining the scalp, neck, and behind the ears. A questionnaire was filled out for all schoolchildren. The study was conducted from April to June 2023.

Ethical Considerations: This research was conducted while ensuring respect for the privacy of the participating individuals and maintaining the confidentiality of the data, while this study was included in the descriptive studies, it does not pose a risk to the participants, it is not an experimental study, and on the contrary, it provides a service to the community by determining the prevalence of head lice in primary schoolchildren.

Epidemiological assessment: A detailed questionnaire was used to collect information about socio-demographic data such as gender, age, nationality, family size, number of family members, father's and

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mother's jobs, educational level of the father and mother, number of brothers in same schools, hair length, color and other relevant data.

The hair was examined clinically to detect the adult head lice, nymphs, and nits by visually examining the scalp, neck, and behind the ears of each child for at least two to five minutes depending on the hair length. A child was considered infested if live head lice or eggs were found.

Statistical Analysis: The data were entered into statistical tables and analyzed using the statistical program. Statistical Package for the Social Sciences (SPSS) software, version 21. To analyze the data statistically, taking into account the probability value (*P*-value). *P* values less than 0.05 were accepted to indicate statistical significance.

Results

- **Head lice infestation rate:** Out of 1006 schoolchildren within the study, 129 schoolchildren showed at least one living adult insect, nymph, or viable nit. The infestation rate was 12.8%.

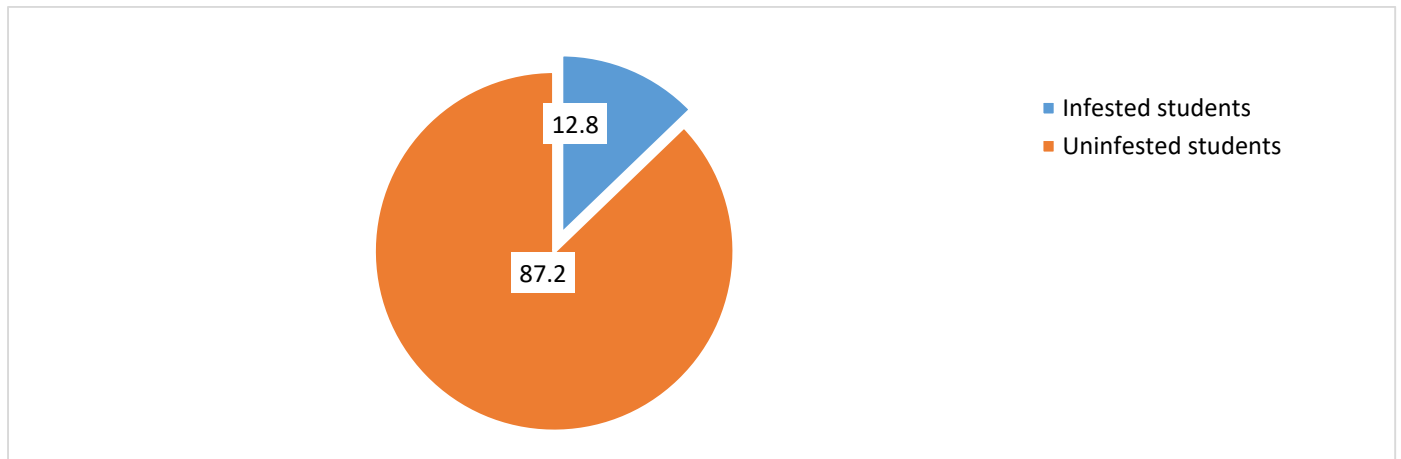


Figure (1): Head lice infestation rate.

- **The infestation rate according to gender:** The study samples included 107/565 infested girls and 22/441 infested boys. Girls showed a higher infestation rate than boys with an infestation rate of 18.9% and 5.0%, respectively. Head lice were more common in girls than in boys, there was a high statistically significant.

Table (1): The infestation rate according to gender.

Study samples		Gender		Total
		Boys	Girls	
Infested	Count	22	107	129
	%	5.0%	18.9%	12.8%
Un infested	Count	419	458	877
	%	95.0%	81.1%	87.2%
Total	Count	441	565	1006
	%	43.8%	56.2%	100%

P=0.000

- **The infestation rate according to age:** The infection rate was high in the ages of 6 years and 12 years, at a rate of 29.4% and 100%, respectively, while the 8-year-old group was infested at a rate of 9.4%, there was a statistical significance.

Table (2): The infestation rate according to age.

Study samples		Age (Year)						Total
		6	7	8	9	10	12	
Infested	Count	5	38	27	24	34	1	129
	%	29.4%	15.2%	9.4%	11.1%	14.6%	100%	12.8%
Un infested	Count	12	212	261	193	199	0	877
	%	70.6%	84.8%	90.6%	88.9%	85.4%	0.0%	87.2%
Total	Count	17	250	288	217	233	1	1006
	%	1.7%	24.9%	28.6%	21.6%	23.2%	0.1%	100%

$P = 0.005$

- **The infestation rate according to school type:** The number of infested schoolchildren in public schools was 13.6%, and in private schools was 8.2 %. We found an increased prevalence of head lice in public schools compared with private schools. The infestation rate among girls in public and private schools 19.8% and 12.7%, respectively, it higher than that of boys in public and private schools 5.2%, 3.9%, respectively.

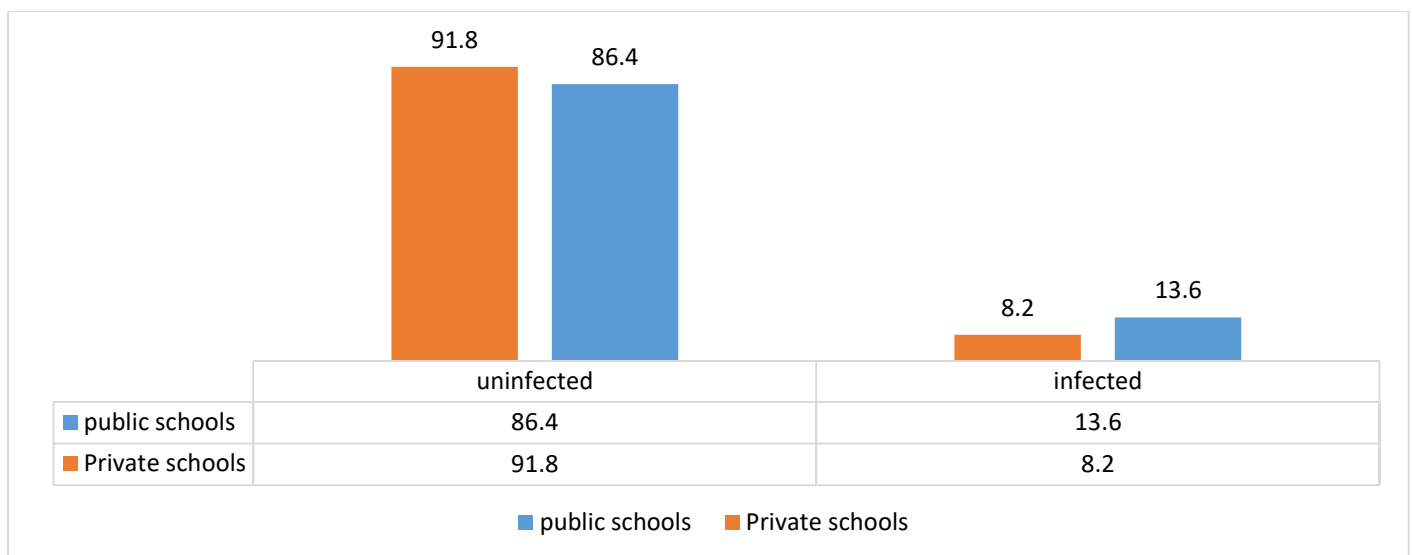


Figure (2): The incidence rate according to school type.

- **The infestation rate according to nationality:** The infestation rate was higher in non-Libyan schoolchildren 15.0% than in Libyan 12.8%, with no statistical significance $P=0.769$

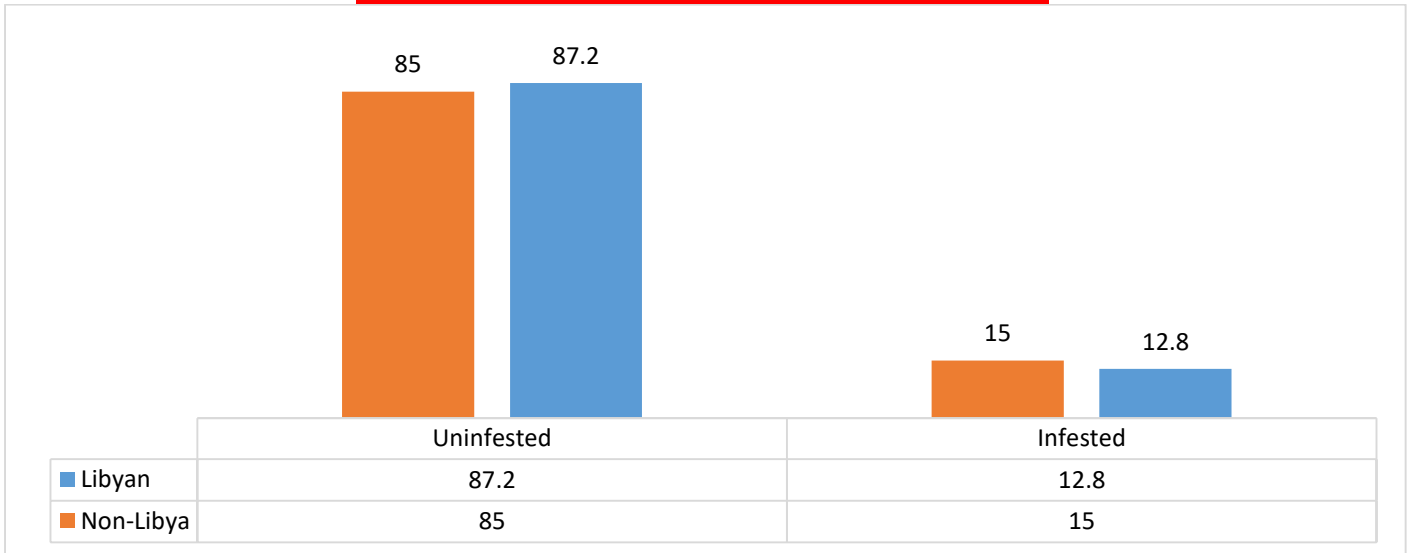


Figure (3): The incidence rate according to the nationality.

- **The infestation rate according to hair covering, softness, length, density and color:** The infestation rate in girls with covered hair was 26.6%, higher than that of hair without a cover 8.6%, with a statistical significance $P=0.000$. The infestation rate in normal hair was 15.8%, greasy hair at 10.2%, and dry hair at 7.7%, with a statistically significant $P=0.001$, and in long hair was 13.2%, short hair 10.6%, and medium hair 18 %, whit a statistical significant $P=0.016$. The infestation rate in thick hair was 15.4%, medium density hair 11.5%, and weak density hair 10.3 %, with no statistically significant $P=0.198$. The infestation rate in black color hair was 11.1%, brown hair 15.9%, and yellow hair 18.8 %, whit no statistically significant $P=0.059$

Table (3) The infestation rate according to hair covering, hair softness, length, density, and color:

Study samples		Infested		Un infested		Total		P
		Count	%	Count	%	Count	%	
Hair covering	Not covered	66	8.6%	703	91.4%	129	12.8%	$P=0.000$
	Covered	63	26.6%	174	26.6%	877	87.2%	
Hair softness	Greasy hair	5	10.2%	44	89.8%	49	4.9%	$P=0.001$
	Dry hair	26	7.7%	311	92.3%	337	33.5%	
	Normal hair	98	15.8%	522	84.2%	620	61.6%	
Hair length	Long hair	25	13.2%	164	86.8%	189	18.8%	$P=0.016$
	Short hair	62	10.6%	522	89.4%	584	58.1%	
	Medium	42	18.0%	191	82.0%	233	23.2%	
Hair density	Thick	55	15.4%	303	84.6%	358	35.6%	$P=0.198$
	Medium	71	11.5%	548	88.5%	619	61.5%	
	Weak	3	10.3%	26	89.7%	29	2.9%	
Hair Color	Black	75	11.1%	600	88.9%	675	67.1%	$P=0.059$
	Brown	45	15.9%	238	84.1%	283	28.1%	
	Yellow	9	18.8%	39	81.3%	48	4.8%	

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- **The infestation rate according to the work of the parents:** The infection rate among children whose fathers do not work was 50%, while among children whose fathers were working 12.1%. As for the work of mothers, the rates were 21.1% and 10.3% for working mothers and housewives, respectively.

Table (4): The infestation rate according to the work of the parents

Study samples		Father's job		Total	Mother's job		Total
		Worked	Not worked		Worked	Housewife	
Infested	Count	112	2	114	49	79	128
	%	12.1%	50.0%	12.3%	21.1%	10.3%	12.8%
Un infested	Count	811	2	813	183	689	872
	%	87.9%	50.0%	87.7%	78.9%	89.7%	87.2%
Total	Count	923	4	927	232	768	1006
	%	99.6%	0.4%	100.0%	23.2%	76.8%	100%
		<i>P=0.015</i>			<i>P=0.000</i>		

- **The infestation rate according to history with head lice:**

The infestation rate in children who had a previous history of head lice infestation was 18.6%, while for those who did not have it was 10.2%, with a statistical significance $P=0.000$

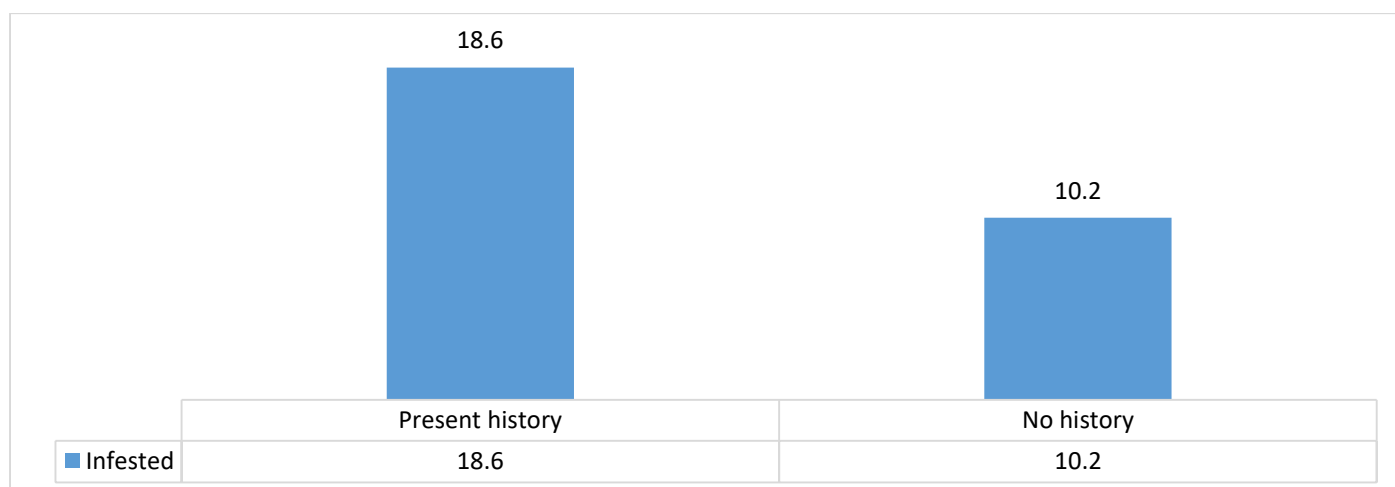


Figure (4) The infestation rate according to history with head lice.

Discussion:

Head lice are a major public health problem, and have been observed to be common among primary schoolchildren with high infestation rates in most parts of the world, different studies show that the infestation rates among schoolchildren have a wide range from 5-80%²¹. In the current study, the infestation rate of *pediculosis capitis* was 12.8%, which indicates the existence problem, and this rate is classified as endemic according to the National Pediculosis Association of the USA, which defines a head-lice infestation rate of more than 5% as an endemicity¹⁸. This rate was lower than recorded in studies conducted in Libya, in

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Benghazi 26.3%²⁷, Sabha 38.6%²⁸, and Houn 21.9%¹. Many studies have reported infestation rates throughout the world among schoolchildren, in Egypt, it varies from 0% to 58.9%²⁹, 26.6% in Jordan²¹, 22.6% in Saudi Arabia³⁰, but our results are higher than those reported in Iraq 9.0%⁵, the USA 1.6%, and France 3.3%³¹. The difference in infestation rates may be due to several factors including population differences in socioeconomic status, poor personal hygiene, rates of head-to-head contact, overcrowded classrooms, family income, and methods of management. There was a significant difference between infestation and gender, our results showed that the rate in girls 18.9% was higher than boys 5%, with girls infested 3.78 fold higher than boys. This difference may not be due to the physiological nature of each of them but may be due to the different behavioral patterns between girls and boys, which affected the infestation rate, also girls play and communicate with each other for a longer time, while boys prefer to play outside, and girls have longer hair than boys, that is a suitable environment for the life and hiding of lice, also the use of hair coverings by girls that help in the transmission of lice from head to head. Similar findings are in agreement with a study reported in Turkey³², Egypt³³, Iran³⁴, Jordan³⁵, and in Iraq the infection rate in girls higher than boys and reached 12.3%, 5.6% respectively⁵, and also agreed the study in Jordan shown that the infestation rate was significantly higher among girls 34.7% than boys 19.6%²¹. While our results differed with study reported 2.74% infestation rate in females and 3.39% in males³⁶. We found significant differences between infestation rates and age groups of schoolchildren, our results reported a higher infestation rate in children at 12 years, followed by the youngest children at 6 years, which was 29%. The lowest rate was at 8 years. The increase in infestation at 6 years may be due to the tendency of children to play together and their inability to take care of themselves, as for the high infestation at 12 years, it is due to their self-reliance in showering and hair styling. Our results agreed with the study which reported the highest prevalence was at 11 years old at 42.9%²⁷, a study conducted in Iran showed a decrease in the incidence rate in 13 years, and the children's age was shown to be associated with infestation³⁷, also, a study showed that the highest infection rate was in students aged 9 years and over³⁸. The results found that the infestation rate in public schools is 13.6%, which is higher than in private schools at 8.2%, and this can be explained by the fact that private schools have a greater interest in personal hygiene and periodic examinations. Our results also showed that the infection rate among girls in public schools 19.8% and private schools 12.7%, was higher than that of boys in public and private schools 5.2%, and 3.9%, respectively. The possible reasons are that economic factors have a role in the spread of head lice, and private schools have more interest and personal hygiene practices than public schools. We also observed the difference between the infestation rate among schools, as it ranged from 6.6% to 22.7%, with a statistical significance, this rate was similar in a study conducted in Baghdad, where the rate ranged between 6.1% to 13.2%⁵. The results also showed that the rate of infestation in girls with covered hair was higher than that of hair without a cover, 26.6% and 8.6%, respectively, with a statistical significance, this may be due to that girls with covered hair being less interested in combing and styling their hair than girls with uncovered hair. Our results showed a statistical significance between the hair softness and infestation rate, where the highest rate in normal hair was 15.8%, followed by greasy hair, and the lowest rate in dry hair, this may be because

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natural hair is a more suitable environment than dry hair and greasy hair for the reproduction of lice, these results agreed with a study that showed that high significance was found between smooth hair and lice infestation, 45.3% of infested children had a smooth hair²⁸. This study also found that the length of the hair has a statistical significance. Children with medium hair were more susceptible to infestation at 18%, followed by long hair at 13.2%, and short hair at 10.6%, This may be because long hair is more difficult to comb and keep clean compared with short hair. These results don't agree with the results of the study in Houn Cit, and the infestation rate was higher in long hair 28.86% than in short hair 17.24% and no infested cases were observed in schoolchildren with medium hair¹, but these results agreed with a study reported by Al Bashtawy & Hasna³⁵. The study also showed that thick hair is more likely to be infested with a rate of 15.4% without any statistical significance. The hair color also had a statistical significance. Our results showed that the rate of head lice infection was high in children whose mothers are working at a rate of 21.1%, with a statistical significance. It also showed a high rate of infection in children whose fathers are unemployed at a rate of 50%, with a statistical significance. This may be due to the poor economic situation if the father does not work. These results agreed with a study that showed the infestation was more common among students with jobless fathers³⁴, but did not agree with a study that showed no effect of parent occupation on pediculosis infestation transmission²⁷. Our results showed that the infestation rate in children who had a previous history of head lice 18.6% was higher than that of those who did not have 10%, with a statistical indication, and this indicates the possibility of recurrence of infection, which may be due to reasons of hygiene, health or social status.

Conclusion

Head lice infestation is a health problem in primary schoolchildren of Misurata City. Girls are infested at a higher rate than boys, family status and social conditions are among the main factors affecting lice infestation. Improving living standards, paying attention to personal hygiene, and raising awareness and education may reduce the significantly increased incidence of head lice infestation among schoolchildren.

Acknowledgments

We would like to express our gratitude to the Department of Epidemiology and Infection Control Faculty of Health Sciences, Misurata University, Misurata, Libya for their support and help during our study

References

1. Ebrahim, H. A. (2019). Infestation of head lice, *Pediculus humanus capitis*, in primary school children at Houn City, Libya. *J Acad Res*, 13, 38-52.
2. Durden, L. A. (2019). Lice (Phthiraptera). In *Medical and veterinary entomology* (pp. 79-106).
3. Frankowski, B. L., Bocchini Jr, J. A., & Council on School Health and Committee on Infectious Diseases. (2010). Head lice. *Pediatrics*, 126(2), 392-403.

4. Gutiérrez, M. M., González, J. W., Stefanazzi, N., Serralunga, G., Yañez, L., & Ferrero, A. A. (2012). Prevalence of *Pediculus humanus capitis* infestation among kindergarten children in Bahía Blanca city, Argentina. *Parasitology research*, *111*, 1309-1313.
5. Al-Barrak, H. T. (2021). Prevalence of head lice (*Pediculus humanus capitis*) among primary school children in Baghdad suburbs. *Med Legal Update*, *21*(1), 280-284.
6. Frey, R. J., & Alic, M. (2011). Lice infestation. *Tersedi di [http://www. Healthofchildren. com](http://www.Healthofchildren.com)*, *9*(05).
7. Ismail, M. T., Kabakibi, M. M., & Al-Kafri, A. (2018). Epidemiology of pediculosis capitis among schoolchildren in Damascus, Syria. *Indian Journal of Paediatric Dermatology*, *19*(4), 331-334.
8. Weems, H. V., & Fasulo, T. R. (2015). Human lice: body louse, *Pediculus humanus humanus* Linnaeus and head louse, *Pediculus humanus capitis* De Geer (Insecta: Phthiraptera (Anoplura): Pediculidae). *The document of EENY-103*, *104*.
9. Service, M. (2012). *Medical Entomology for Students*. New York: Cambridge University Pre, 191-199
10. Zubair. M., Ashraf. T., Khadim. S ., *et al* (2020). Epidemiology of head lice with reference to diagnosis and treatment. *IEEE-SEM*, Volume 8, Issue 2, ISSN 2320-9151. 51-65
11. Elgart, M. L. (1990). Pediculosis. *Dermatologic clinics*, *8*(2), 219-228.
12. Yang, Y. C., Lee, H. S., Clark, J. M., & Ahn, Y. J. (2004). Insecticidal activity of plant essential oils against *Pediculus humanus capitis* (Anoplura: Pediculidae). *Journal of medical entomology*, *41*(4), 699-704.
13. Bartosik, K., Janczaruk, M., Zajac, Z., Sędzikowska, A., Kulisz, J., & Tytuła, A. (2022). Head Lice Infestation in Schoolchildren, in Poland—Is There a Chance for Change?. *Journal of Clinical Medicine*, *11*(3), 783.
14. Trasia, R. F. (2023). Prevalence of Pediculosis Capitis in Indonesia. *Insights in Public Health Journal*, *3*(1).
15. Vahabi, B., Vahabi, A., Gharib, A., Sayyadi, M., & Sayyad, S. (2013). Prevalence of head louse infestations and factors affecting the rate of infestation among primary schoolchildren in Paveh City, Kermanshah Province, Iran in the years 2009 to 2010. *Life Sci J*, *10*(12s), 360-4.
16. Burgess, I. F., Lee, P. N., Kay, K., Jones, R., & Brunton, E. R. (2012). 1, 2-octanediol, a novel surfactant, for treating head louse infestation: identification of activity, formulation, and randomised, controlled trials. *PLoS One*, *7*(4), e35419.
17. Salehi, S., Ban, M., & Motaghi, M. (2014). A study of head lice infestation (*Pediculosis capitis*) among primary school students in the villages of Abadan in 2012. *International journal of community based nursing and midwifery*, *2*(3), 196.-200.
18. Frankowski, B. L. (2004). American Academy of Pediatrics guidelines for the prevention and treatment of head lice infestation. *Am J Manag Care*, *10*(9 Suppl), S269-72.
19. Farzinnia, B., Hanafi Bojd, A. A., Reis Karami, S. R., & Jafari, T. (2004). Epidemiology of pediculosis capitis in female primary school pupils Qom. 2003. *Hormozgan Medical Journal*, *8*(2), 103-108.
20. Nordin, R. B., Che, W. A., Ibrahim, N. A., & Naing, L. (2006). Prevalence and associated factors of head lice infestation among primary schoolchildren in Kelantan, Malaysia. *Southeast Asian Journal of Tropical Medicine and Public Health*, *37*(3), 536.
21. Mohammed, A. (2012). Head lice infestation in schoolchildren and related factors in Mafrag governorate, Jordan. *International Journal of Dermatology*, *51*(2), 168-172.
22. Ismail, M. T., & Al Kafri, A. (2008). Parasitology and Medical Mycology. *Syria: Damascus University Publication*, 129-34.

23. Pai, K. S., Park, M. S., Lee, Y. S., Kim, D. H., Chung, K. S., Lee, ... & Huh, S. (1989). The prevalence of head louse infestation among urban and rural children in Korea. *The Korean Journal of Parasitology*, 27(4), 271-275.
24. Borges, R., Mendes, J. (2002). Epidemiological aspects of head lice in children attending day care centres, urban and rural schools in Uberlandia, central Brazil. *Mem Inst Oswaldo Cruz, Rio de Janeiro*, 97(2): 189-192.
25. Trasia, R. F. (2023). Prevalence of Pediculosis Capitis in Indonesia. *Insights in Public Health Journal*, 3(1).
26. Bharija, S. C., Kanwar, A. J., Singh, G., & Belhaj, M. S. (1988). Pediculosis capitis in Benghazi, Libya: A school survey. *International journal of dermatology*, 27(3), 165-166.
27. Alarifi, S. A., Alsdad, G., & A Duweb, G. (2022). Factors Affecting Pediculosis capitis Transmission among Primary School Children. *International Journal of TROPICAL DISEASE & Health*, 43(17), 8-13.
28. Ibrahim, H. M., & Mohamed, H. O. A. (2020). Prevalence and associated factors of Pediculus humanus capitis infestation among primary schoolchildren in Sebha, Libya. *Journal of Pure & Applied Sciences*, 19(5), 132-138.
29. Mimouni, D., Ankol, O. E., Gdalevich, M., Grotto, I., Davidovitch, N., & Zangvil, E. (2002). Seasonality trends of Pediculosis capitis and Phthirus pubis in a young adult population: follow-up of 20 years. *Journal of the European Academy of Dermatology and Venereology*, 16(3), 257-259.
30. Al-Najjar, H., Al-Arousi, W., Hilal, H. (2018). The effectiveness of a head lice treatment program in Bahra primary schools. *World Journal of Nursing Sciences* 4(3), 71-83.
31. Williams, L. K., Reichert, A., MacKenzie, W. R., Hightower, A. W., & Blake, P. A. (2001). Lice, nits, and school policy. *Pediatrics*, 107(5), 1011-1015.
32. Gulgun, M., Balci, E., Karaoglu, A., Babacan, O., & Turker, T. (2013). Pediculosis capitis: prevalence and its associated factors in primary school children living in rural and urban areas in Kayseri, Turkey. *Central European journal of public health*, 21(2).
33. Abd El Raheem, T. A., El Sherbiny, N. A., Elgameel, A., El-Sayed, G. A., Moustafa, N., & Shahan, S. (2015). Epidemiological comparative study of pediculosis capitis among primary school children in Fayoum and Minofiya governorates, Egypt. *Journal of community health*, 40, 222-226.
34. Moosazadeh, M., Afshari, M., Keianian, H., Nezammahalleh, A., & Enayati, A. A. (2015). Prevalence of head lice infestation and its associated factors among primary school students in Iran: a systematic review and meta-analysis. *Osong public health and research perspectives*, 6(6), 346-356.
35. Al Bashtawy, M., & Hasna, F. (2012). Pediculosis capitis among primary-school children in Mafrq Governorate, Jordan. *EMHJ-Eastern Mediterranean Health Journal*, 18 (1), 43-48, 2012.
36. Elserite, F. S. (2016, September). Prevalence of pediculosis among urban–rural school children in Misurata–Libya. In *The Third Symposium on Theories and Applications of Basic and Biosciences. 3ed September*.
37. Salemi, J. A., Shayeghi, N., Zeraati, H., Akbarzadeh, K., Basseri, H. & Rafinejad, J. (2003). Some aspects of head lice infestation in Iranshahr area (southeast of Iran). *Iranian Journal of Public Health*, 32(3), 60-63.
38. Soleimani-Ahmadi, M., Jaberhashemi, S. A., Zare, M., & Sanei-Dehkordi, A. (2017). Prevalence of head lice infestation and pediculicidal effect of permethrin shampoo in primary school girls in a low-income area in southeast of Iran. *BMC dermatology*, 17(1), 1-6