

PREVALENCE OF *Pediculus humanus capitis* IN NORTHERN JORDAN

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ABSTRACT

Pediculosis caused by *Pediculus humanus capitis* is a public health problem that mainly affects schoolchildren aged three to 12 years old. Limited knowledge is available about the prevalence of pediculosis among schoolchildren in northern Jordan. The study aimed to determine the prevalence of pediculosis capitis and associated risk factors among primary schoolchildren in northern Jordan. A total of 3038 students from 16 primary governmental schools were screened for head lice using combs and hand magnifiers (20x), in addition to direct inspection. Demographic and socio-economic information and other relevant data were collected using a questionnaire. SPSS was used to analyze collected data. Only 76 students were infested (2.5%), where boys showed lower prevalence (1.9%) than girls (3.1%). The gender, family size and hair length had a significant impact on the rate of infestation (P -value <0.05 was considered statistically significant). Other risk factors that have been studied showed an impact on the prevalence rates but without statistically significant relationships. The low prevalence of pediculosis observed in this study may be associated with improvements in socioeconomic conditions and ongoing public health awareness efforts in Jordan.

Keywords: Human lice; Northern Jordan; pediculosis; prevalence

ABSTRAK

Pedikulosis yang disebabkan oleh *Pediculus humanus capitis* merupakan satu masalah kesihatan awam yang menjejaskan kanak-kanak sekolah berumur antara tiga hingga 12 tahun. Maklumat mengenai sebaran pedikulosis dalam kalangan murid sekolah di utara Jordan masih terhad. Kajian ini bertujuan untuk menentukan sebaran pedikulosis kapitis serta faktor risiko yang berkaitan dalam kalangan murid sekolah rendah di utara Jordan. Sejumlah 3038 murid daripada 16 buah sekolah rendah kerajaan telah disaring untuk kehadiran kutu kepala menggunakan sikat halus dan kanta pembesar (20x), selain pemeriksaan secara langsung.

Maklumat demografi, sosioekonomi serta data berkaitan lain dikumpulkan melalui soal selidik. Data yang diperoleh dianalisis menggunakan perisian SPSS. Hanya 76 murid didapati dijangkiti (2.5%), di mana murid lelaki menunjukkan sebaran yang lebih rendah (1.9%) berbanding murid perempuan (3.1%). Faktor jantina, saiz keluarga dan panjang rambut didapati mempunyai kesan yang signifikan terhadap kadar infestasi (nilai $P < 0.05$ dianggap signifikan secara statistik). Faktor risiko lain yang dikaji menunjukkan kesan terhadap kadar sebaran, namun tidak mempunyai hubungan yang signifikan secara statistik. Sebaran pedikulosis yang rendah dalam kajian ini mungkin berkait dengan peningkatan keadaan sosioekonomi serta usaha berterusan dalam kesedaran kesihatan awam di Jordan.

Kata kunci: Kutu manusia; Utara Jordan; pedikulosis; sebaran

INTRODUCTION

Pediculosis is a human parasitic infestation caused by lice of the order Phthiraptera (Adrus et al. 2021; Razali et al. 2018). Pediculosis capitis (head lice infestation) is still a global public health issue in both developed and developing countries (Delie et al. 2024). The infestation mainly spreads by direct contact with the infected person or indirectly with personal belongings. It is estimated that head lice infest 100 million people worldwide annually (Coates et al. 2020). Children between 3 and 12 years are at high risk for pediculosis (Amr & Nusier 2000), with an estimated global prevalence reaching 19% (Delie et al. 2024).

Pediculosis may be asymptomatic, particularly during early infestation or first-time exposure; however, it is more commonly associated with pruritus in cases of heavier infestation due to hypersensitivity reactions to lice saliva. Persistent scratching may lead to scalp lesions that develop secondary infections (Devore & Schutze 2015). On the other hand, infestation may disrupt daily life, particularly for schoolchildren resulting in psychological stress and frustration (Amr & Nusier 2000).

Several studies have been conducted on pediculosis capitis in the Middle East region. Most studies were epidemiological investigations that studied the disease prevalence among school-aged children. In Iran, the estimated prevalence was 7.52% and the most important risk factors were gender and father's occupation (Akbari et al. 2022). Several studies have found the rate of infestation ranged between 5.4% and 30.4% in different provinces in Turkey (Özden et al. 2023). These variations may be attributed to differences in methodology including sample size, sampling method, study design, diagnostic technique, and definition of infestation. Moreover, demographic, socioeconomic, behavioral, and environmental factors may also have a role.

Saudi Arabia and Iraq are well studied among the Arab countries of the Middle East. Various studies were carried out in different provinces of Saudi Arabia to investigate prevalence, attitude awareness, and treatment (Abdullah & Kaki 2017; Al-Saeed et al. 2006; Al-Shahrani et al. 2017; Moussa et al. 2018). In Iraq, the epidemiology of pediculosis was investigated by several authors revealing a wide range of prevalence rate between 7.2% and 25.5% (AL-Marjan et al. 2022; Rasheed & Al-Nasiri 2021; Sulaiman et al. 2020). Gaza strip, Qatar, Oman, Syria, and Kuwait were fragmentarily studied (Alzain 2012; Al-Abdulla & Selim 1995; Henedi et al. 2019; Kumar 2019).

In Jordan, lice infestations were rare and the prevalence was negligible in the past. Over its history, Jordan has undergone significant social and economic changes, including a

population increase brought on by mass immigration after the 1967 Arab-Israeli War, exodus of Jordanians from Kuwait following First Gulf War 1990 and massive influx of Iraqi and Syrian refugees during 1993 and 2011. These events overburdened the Jordanian healthcare and education systems. Consequently, overcrowding in schools and high demand for health services became very clear. These changed the pattern of pediculosis among different socioeconomic demographic groups in Jordan.

Several studies have addressed pediculosis capitis in Jordan. However, these studies showed contrasting results between the studied regions of the country. While Khamaiseh (2018) studied southern Jordan, several studies have been conducted in the North and East of the country. The prevalence of pediculosis in northern and eastern Jordan ranged from 6.7% to 26.6% (Amr & Nusier 2000). In South of Jordan, the prevalence was 20.4% (Khamaiseh 2018). The current study aims to investigate the prevalence of pediculosis capitis in the northern part of Jordan.

MATERIALS AND METHODS

Sampling and Collection of Data

Epidemiology of pediculosis in northern Jordan was studied using a cross-sectional design. During the period from September to December 2023, a total of 3038 schoolchildren aged 4 - 11 from 16 governmental primary schools in northern Jordan were screened for pediculosis. Two well trained inspectors checked the students' hair for all stages of head lice using disposable fine-tooth hair combs and hand magnifiers (20x). Hair of each participant was dampened prior systematic combing for 3 – 5 minutes, to enhance the sensitivity of detecting adult lice and nits (Fry et al. 2002). The student was deemed to be infected if adult lice or eggs were found. The collected lice were kept in 75% alcohol for later examination in the laboratory. To prevent contamination in the field settings, one disposable comb per child was used, and then placed in a sealed plastic bag to properly dispose of it later.

To find out the risk factors that contribute to the prevalence of pediculosis capitis, a pre-test questionnaire was created to gather such information. The questionnaire included age, gender, student's grade, parents' educational attainment, employment status of the parents, family income, and bathing facilities availability and personal hygiene (frequency of bathing, hair washing, sharing items, and hair length). The questionnaire was distributed by hand, and the students were asked to complete it with parental assistance. The student who sent back his/her questionnaire was examined for the presence of head lice.

The study tool (questionnaire) used in the current study was evaluated by a group of educators in the field and child development experts. To assess clarity, a pilot test was conducted on a small group of the students. Based on the students feedback no major issues were identified. This study was conducted in accordance with principles of human research ethics. Institutional Review Board (IRB) of AL al-Bayt University (No. ERB_AABU_8) and Ministry of Health (No. MOH/REC/2023/315) approved the study. The Ministry of Education gave its permission for the examination of students in its schools based on approvals granted by AL al-Bayt University and Ministry of Health. The objectives of the study were explained to the parents, and they were reassured that their children's participation in the study is voluntary and they can leave at any moment. In order to maintain the students' privacy, they were asked not to write their names on the questionnaires, and a code number for each one was assigned. The safety, autonomy, and dignity of every student were maintained during the study.

An effort was made to minimize bias that may arise due to methods of data collection during the study. To estimate accurately the prevalence rate, we used rigorous techniques like wet combing as indicated earlier, and did not rely solely on visual inspection. Moreover, the questionnaire used in the study was designed to ensure the student's anonymity to reduce social desirability bias.

Statistical Analysis of Data

SPSS software was utilized to analyze the collected data. The frequencies and percentages of studied variables (age, sex, income, father and mother education, family size, father and mother occupation, hair length, bathing time, sharing articles, and availability of health supervisor) were tabulated and Chi-square was used to assess the relationships between the studied variables. A P -value of <0.05 was considered statistically significant.

RESULTS

A total of 3038 primary school students (boys=1400; girls=1638) were examined for the presence of head lice. The overall infestation rate was 2.5%. As shown in Table 1, the prevalence was significantly lower among boys (1.86%) compared with girls (3.1%). The current study investigated the risk factors associated with pediculosis, which were grouped into sociodemographic characteristics and child-related factors.

Table 1. Prevalence among examined schoolchildren according to sex and age group

Main category	Sub-category	Examined	Positive	Prevalence %	P value
Sex	Male	1400	26	1.9	0.023
	Female	1638	50	3.1	
Age	KG-1 (= 4 yrs old)	12	0	0	0.734
	KG-2 (= 5 yrs old)	169	3	1.8	
	1 st grade (= 6 yrs old)	660	17	2.6	
	2 nd grade (=7 yrs old)	525	13	5.2	
	3 rd grade (=8 yrs old)	416	14	3.4	
	4 th grade (=9 yrs old)	518	9	1.5	
	5 th grade (=10 yrs old)	438	12	2.7	
6 th grade (=11 yrs old)	300	8	2.7		

Prevalence Rate of Pediculosis and Sociodemographic Characteristics.

Examined students in the current study were aged 4 – 11 years. Schoolchildren from second grade showed the highest prevalence (5.2%), followed by those in third grade (3.4%). Fifth and sixth grade students each showed a prevalence of 2.7%, while the least infestation rates were recorded in KG-2 (1.8%) and fourth grade (1.5%). Students of the first grade showed a prevalence almost equal to that of fifth and sixth grades (Table 1). Overall, statistical analysis showed no significant relationship between age and pediculosis.

The prevalence of pediculosis was higher among students from families with a monthly income of 200 to 500 JOD (300 – 750 US\$) and among participants, whose parents have a low educational level (Table 2). Moreover, the father's occupation has a higher impact on the infestation rate comparing with the mother's occupation. However, these risk factors were statistically insignificant ($P>0.05$).

Students from families with a higher number of individuals showed higher prevalence rate, with rates increasing as household size increased. The highest infestation rate was recorded among students from families with more than five members, and this association was statistically significant ($P=0.002$).

Table 2. Infestation among schoolchildren according to sociodemographic characteristics

Main Category	Sub-category	Examined	Positive	Prevalence %	P value
Income	Less than 200 JD	107	2	1.9	0.616
	200 - 500 JD	2251	60	2.7	
	More than 500 JD	680	14	2.1	
Father Education	School Education	1764	50	2.8	0.237
	College Education	1235	26	2.1	
	Higher Education	39	0	0	
Mother Education	School Education	1472	46	3.1	0.086
	College Education	1543	30	1.9	
	Higher Education	23	0	0	
Family Size	4 members	328	4	1.2	0.002
	5 members	905	12	1.3	
	More than 5 members	1805	60	3.3	
Father Occupation	Employed	2933	74	2.5	0.612
	not employed	105	2	1.9	
Mother Occupation	Employed	680	16	2.4	0.773
	not employed	2358	60	2.5	

Prevalence Rate of Pediculosis According to the Students' Characteristics and Hygiene Practice.

The length of hair significantly affects the infestation rate ($P=0.023$). Students with long hair showed the highest infestation rate (3.08%), compared with short (3.02%) and medium (1.43%) hair lengths (Table 3). The infestation rate was higher among students who less frequently washed their hair and shared their items (combs, scarves, and towels) and rooms. However, these factors did not show a statistically significant correlation with pediculosis (Table 3). The presence of a health supervisor reduced the prevalence of pediculosis among the examined schoolchildren, but the statistical analysis presented an insignificant relationship.

Table 3. Infestation of pediculosis according to students' characteristics and hygiene practice

Main category	Sub-category	Examined	Positive	Prevalence %	P value
Hair length	Short (less than 3cm)	364	11	3.02	0.023
	medium (to the shoulder level)	1048	15	1.43	
	long (below shoulder level)	1625	50	3.08	
Bathing times	Daily	749	12	1.6	0.303
	Once weekly	1141	34	3	
	Thrice weekly	1147	30	2.6	
	Once/two weeks or more	1	0	0	
Sharing Articles	Yes	804	21	2.61	0.963
	No	2234	55	2.46	
Health supervisor	Yes	1910	42	2.2	0.164
	No	1128	34	3.01	

DISCUSSION

Pediculosis is a public health problem. It is a prevalent issue among school-aged children especially the first six grades in addition to kindergartens (Delie et al. 2024). It can lead to adverse psychological consequences including shame, social stigma, embarrassment, and a fear of being judged on the students and their families. This condition may cause students to leave the school, so managing pediculosis is a crucial concern. Although attempts have been made to reduce the rate of head lice infection, it is still estimated that 19% of schoolchildren globally are impacted (Delie et al. 2024). This study sought to assess the status of pediculosis and the contributing risk factors in elementary schools' students in northern Jordan.

According to the current study, the total prevalence rate of pediculosis was 2.5%. This finding was comparable to other studies conducted in different countries; 2.1% in Korea (Ryoo et al. 2023), 2.01% in Poland (Bartosik et al. 2015), and 2% in Iran (Kassiri & Gatifi 2016). However, the current finding was substantially lower than reported prevalence in other countries; 14.3% in Syria (Ismail et al. 2018), 27.44% in Iraq (Sulaiman et al. 2020); 58.5% in Yemen (Bamaga et al. 2021). This variation in infestation rates can be attributed to sociodemographic factors (sex, Age, family income, mother education, and family size) and hygiene practices of infested children (hair length, history of lice infestation, and sharing items).

North of Jordan was previously studied by two studies only (Amr & Nusier 2000; Daraghme 1993). There was a discernible difference in the pediculosis rate between current study (2.5%) and earlier ones (13.2%). The reported higher prevalence rate in the 1990s and early 2000s was attributed to low socioeconomic status and poor hygiene and living conditions (Amr & Nusier 2000).

However, during the last 30 years, Jordan has witnessed notable socioeconomic progress due to government programs and support from non-governmental organizations (Hajar & Hajar 2024). Women have progressively gotten more access to economic

opportunities, healthcare, and education. Moreover, several aid types (e.g. financial aid, housing support, increasing social security benefits) were implemented to help low-income families and to reduce poverty. A developed socioeconomic standing gives people improved cleanliness, education and medical care, which reduces the risk and impact of pediculosis.

The low infestation rate (2.5%) reported in the current study suggests a possible enhanced hygiene practices and adequate awareness of preventive measures compared to previously reported higher rates. This finding may reflect the success of ongoing public health measures and school-based interventions. However, despite the low prevalence, continued monitoring and preventive efforts, such as health education and routine screening, remain important to maintain effective control and prevent potential re-emergence of pediculosis.

In consistent with global findings, the current study found the prevalence of pediculosis among girls (3.1%) was higher than boys (1.9%). Girls are more likely to have head lice due to their social interactions and hair type. Girls are usually sharing their hair items (brush, comb, hat and headscarf), which makes lice transmission easier (Kamiabi & Nakhaei 2005). In addition, girls related behavior such as wearing scarves and having long hair might facilitate lice attachment and make detection and treatment more difficult.

The study revealed a statistically significant relationship between infestation rate and hair length, implying that longer hair may increase the risk of pediculosis. Longer hair increases opportunities for lice to spread by providing more surface area to attach and move. These findings were in line with other studies (Rassami & Soonwera 2012; Saddozai & Kakarsulemankhel 2008). These findings emphasize the importance of hair length in prevention measures such as regular inspection and appropriate hair care in the schools.

On the other hand, pediculosis is associated with different socio-economic risk factors. Our findings revealed family size, parents' education and family income are important factors in the prevalence of pediculosis in northern Jordan. Smaller family size, better parents' education and higher income often lead to higher socio-economic status.

Family size is an important risk factor for pediculosis. The current study found a significant difference between rate of pediculosis and family size ($P=0.002$). Larger families are associated with increased opportunities for close contact, frequent sharing items, and often occupy smaller living areas, which can lead to overcrowded settings. Similar results were found in Libya (Shibani et al. 2025) and Tunisia (Farjallah et al. 2024).

Pediculosis capitis is distributed globally with prevalence varying by region. In Jordan, the prevalence varies from 6.7% to 26.6% (AlBashtawy & Hasna 2012; AlBashtawy 2014; Amr & Nusier 2000; Khamaiseh 2018; Rabi et al. 1996; Shakkoury & Abu-Wandy 1999). Various factors contributed to regional differences in pediculosis prevalence in Jordan. Population density, health facilities, socioeconomic status, personal hygiene, availability of health practitioners affect the prevalence of pediculosis.

Nearly all associated risk factors that affect head lice prevalence are health, behavior, culture, and socioeconomic status-related categories. In northern Jordan, implementing healthy behavior and culture regarding personal hygiene like keeping hair short and neat, washing it more often, not sharing a towel and comb, and treating infected children quickly and effectively, enabled the government to reduce the prevalence of pediculosis among schoolchildren. Moreover, During the Syrian refugee crisis, the Ministry of Education

accommodated the increased student population by adding double-shift schools in areas where Syrian refugees are concentrated (UNESCO 2019). This intervention made classrooms less crowded, which reduced the opportunity to transmit head lice.

CONCLUSION

The current study revealed a low prevalence of pediculosis (2.5%) among schoolchildren, suggesting that enhancement in the living standards (public health infrastructures, education and access to healthcare) that Jordan has witnessed were largely impactful. However, hair length, family size, and sex were found to be important risk factors. These findings highlight the importance of public health initiatives, including school-based programs, awareness campaigns, and targeted education for larger households, to reduce the risk of potential outbreaks. Continued pediculosis surveillance is crucial to enhance the understanding of such public health concerns, support the management of psychological impacts of infestation particularly among children, and improve the treatment effectiveness and prevention plans.

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AUTHORS DECLARATION

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Conflicts of Interest

The authors declare that they have no competing interest.

Data Sharing Statement

The datasets generated and/or analyzed during the current study are not publicly available due to privacy or ethical restrictions, but are available upon reasonable request from the corresponding author.

Authors' Contributions

Hazem AbduRa'of Al-Talafha (HAT) was responsible for formal analysis, funding acquisition, investigation, methodology, project administration, supervision, and writing of the original draft. Zuhair Sami Amr (ZSA) contributed through supervision as well as reviewing and editing the manuscript. Fawzi Irshaid (FI) provided supervision throughout the study. Sultan Issa Al-Rwis (SIR) was involved in data curation and conducted data analysis using software tools. Worood Abualoush (WA) contributed to the methodology and provided essential resources for the study.

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