



Head lice (*Pediculus humanus capitis*) infestation and the role of health education in limiting its spread among children at Primary-School in Misurata, Libya

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ABSTRACT

Pediculus humanus capitis is a worldwide scourge and children are more susceptible to infection than adults. Therefore, implementing health education programmes to control the spread of Head lice requires a great effort from teachers and parents. This study was conducted from November 2019 to February 2020 at some primary schools in Misurata city. The study community included 825 (male & female) students between the ages of 7 and 12. A first test was conducted to detect the prevalence of the infection with *Pediculus humanus capitis* among students and the main influencing risk factors. Another test was conducted to achieve the effectiveness of health education in reducing infection. The results of this study revealed that the number of children with *Pediculus humanus capitis* was 197 i.e. (23.9%) out of the 825 examined students. This percentage has decreased to (11.5%) following the intervention of health education programmes, with a statistical significance of ($P < 0.05$). Among the factors, the study showed two significant correlations ($P < 0.05$). The first was between the infection rate and the participants' sex as the highest rate of infection was recorded among females at (31.1%). The other significant correlation was between the infection rate and the age, with the highest rate reaching (33.9%) among those aged 7 years. It is concluded that the infection with *Pediculus humanus capitis* has increased among primary-school students in Misurata when compared to other related studies. However, health awareness programmes at schools proved to have a beneficial effect in preventing and controlling the infection with *Pediculus humanus capitis*.

الإصابة بقمل الرأس (*Pediculus humanus capitis*) ودور التثقيف الصحي في الحد من انتشاره بين أطفال المرحلة الابتدائية بمدينة مصراتة، ليبيا

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الكلمات المفتاحية:

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المخلص

يعتبر قمل الرأس آفة في جميع أنحاء العالم والأطفال أكثر عرضة من البالغين للعدوى، لذلك فإن تطبيق برامج التوعية الصحية للسيطرة على انتشار قمل الرأس يتطلب جهداً مركزاً من قبل معلمي المدارس وأولياء الأمور. أجريت هذه الدراسة خلال الفترة الزمنية من شهر نوفمبر 2019 إلى شهر فبراير 2020 في بعض مدارس المرحلة الابتدائية في مدينة مصراتة، شمل مجتمع الدراسة 825 طالب (ذكور وإناث) تراوحت أعمارهم بين 7-12 سنة. واجري الفحص الأول للكشف عن انتشار القمل بين الطلبة وعوامل الخطر الرئيسية المرتبطة بالإصابة بقمل الرأس، واجري فحص آخر بعد تحديد الانتشار لاختبار مدى فعالية التثقيف الصحي في الحد من الإصابة بالقمل. أظهرت نتائج هذه الدراسة أن عدد الأطفال المصابين بقمل الرأس البشري بلغ 197 طفلاً بنسبة (23.9%) من أصل 825 طالباً تم فحصهم. وقد انخفضت هذه النسبة إلى (11.5%) بعد تدخل برامج التثقيف الصحي،

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بدلالة إحصائية ($p < 0.05$). من بين العوامل ، أظهرت الدراسة ارتباطين معنويين ($p < 0.05$). الأول كان بين معدل الإصابة و جنس الطلبة حيث سجلت أعلى نسبة إصابة بين الإناث (31.1%). أما الارتباط الآخر المعنوي فكان بين معدل الإصابة والعمر حيث كانت أعلى نسبة إصابة في عمر 7 سنوات بنسبة 33.9%. نستنتج من دراستنا أن الإصابة بقمل الرأس ازداد انتشارا بين طلاب المرحلة الابتدائية في مدينة مصراتة ، مقارنة بالدراسات السابقة في ليبيا ، وان برامج التوعية الصحية في المدارس لها تأثير مفيد في الوقاية والسيطرة على الإصابة بقمل الرأس.

Introduction

The Lice can be described as small, permanent, ectoparasite, that do not have strong jumping legs. They move from one person to another using the claws on their legs, and they feed throughout the several stages of their life cycle, by sucking blood [1]. Humans are vulnerable to three types of *Pediculus*, namely: *Pediculus humanus capitis*, (head louse), *Pediculus humanus humanus* (body louse) and *Pthirus pubis* (crab louse) [2] [3] [4].

The presence of a large number of *Pediculus* on one person's head is referred to as *pediculosis* [5] [6]. The infection with *Pediculus humanus capitis* is spread world wide affecting public health in both developed countries and developing countries [7] [8]. Severe infections are usually associated with low socio-economic status, hair characteristics, parasite resistance to pesticides and cultural habits [9] [10]. Although it has been detected among all age groups, primary school children especially females have shown to be the most affected. It has also been noticed that the most affected areas of one's head are the occipital area and the near-ear areas [11] [12].

Pediculus humanus capitis are transmitted by close contact with the infected person or through sharing of hair combs and headress or something similar [13]. School environments can also increase the vulnerability of the process of mutual transport, which can be passed on to family members [14] [15].

Pediculus can lead to severe itching in the scalp, loss of sleep, irritation, dermatitis, and secondary bacterial infections [16]. Moreover sometimes, excessive infection can lead to school children having anaemia [17], yet the infection could be asymptomatic [7]. In addition to the above symptoms, the infection may cause social embarrassment and isolation, parental anxiety, peer criticism, psychological distress, difficulties in concentration, poor learning performance among children and unnecessary absence from school [18] [19] [20].

It is increasingly recognised that schools play an important role in instilling healthy and psychological habits among the younger generations [21]. Health education programmes including (workshops for teacher, video drawings, posters, leaflets, and drawing activities) can therefore have a beneficial effect on preventing and controlling the spread of *Pediculus humanus capitis*. However, there has been little concern for the effectiveness of health education on the prevalence of *Pediculus humanus capitis* at schools [22] [13].

Although *Pediculus humanus capitis* is a major public health problem and one of the most common parasitic diseases in children, there is a lack of evidence on the prevalence of this infection and a lack of health education in this study's area (Misurata). The main objectives of this research was to identify the prevalence of *Pediculus humanus capitis* and its associated risk factors, and to provide sufficient information about it among primary school students, through awareness programmes provided by health supervisors to those schools in order to prevent and control the infection.

Methods and Materials:

Results:

1- The Prevalence of *Pediculus humanus capitis* among Children at Primary Schools:

This study found out that 197 samples were positive with *Pediculus*

The Study Settings:

This study was conducted in some , randomly selected, primary schools in the city centre and suburbs of Misurata from November 2019 to February 2020, to detect the prevalence of *Pediculus humanus capitis* among primary school students. The study community included 825 students (males, females) aged 7-12.

Sample examination:

The first examination of the scalp was conducted for 3-5 minutes with the unaided eye, sometimes using a magnifying glass focusing on the neck and behind the ears during the examination, in order to detect *Pediculus* or nits. A child was regarded as an infected case with *Pediculus* (adults), if nymphs or eggs were observed. A detailed questionnaire was given to students to fill out manually supported by their school health supervisors. The questionnaire consisted of the following data, sex, class, over crowdedness in the classroom, place of residence, frequency of washing hair during the week, exchange of personal items (combs and scarves), and hair characteristics (length and thickness). The collected data was kept confidential.

Ethics Statement:

The research erhad the permission to conduct the study from each school's principle.

A written consent has been obtained from each child.

A consent has been obtained from each student's guardian.

Development of Health Education Material:

Health education materials were prepared after identifying the prevalence and major risk factors associated with *Pediculus humanus capitis*. The materials included topics such as explaining the life cycle of *Pediculus*, means of transportation, signs and symptoms, diagnosis, treatment, prevention and control, and the preparation of posters, and drawings of the parasite. These were delivered through workshops formulated by health supervisors at the schools, in a simple language suitable for students. In addition, letters were sent to parents in order to educate them on the importance of the prevention and the treatment of the infection, especially when their children feel an itchy scalp or have a feeling of something moving in their hair. This workshop lasted for two months. Then another examination of the students' hair was conducted, and the results were compared with those of the first examination.

Statistical Analysis:

After the results were obtained, the data were analysed using (SPSS.26) where we used descriptive methods to analyse the data statistically, and the results were considered 'significant' if the value is (p -value ≤ 0.05), using the Chi-square test, proportion test. This was conducted in accordance with the established scientific and statistical standards and principles.

humanus capitis out of 825 examined primary school children, i.e., a

prevalence ratio of 23.9%. The statistical analysis showed that this value represents a statistical indication of $p=0.000$ as seen in Table 1.

Table 1:Prevalence of *Pediculus* among Primary School Children

Number of students (Male& Female)	Number of Positive samples (%)	Number of Negative samples (%)	p- value
825	197 (23.9%)	628 (76.1%)	0.000

2- Study of Some Factors that may have a role in the spread of *Pediculus humanus capitis*:

The correlation between *Pediculus*,sex and age of the student, showed that the highest incidence was among females with an infection rate of 31.1%. Regarding the age groups, the students examined in this research ranged from 7 to 12 years old. The study revealed that the highest rate of infections was among children aged

7 year (first grade) with a percentage of 33.9% out of the total number of samples. The difference is significant representing a statistical significant indication ($p=0.000$) among the sex of students, their age, and the rates of infection.

Table 2:Correlation between the *Pediculus humanus capitis* and students' (sex & age):

Factor	Number of samples		Number of Positive samples		p- value
	Number	(%)	Number	(%)	
Sex					
Male	375	(45.5%)	57	(15.2%)	0.000
Female	450	(54.5%)	140	(31.1%)	
Age (years)					
7 years	165	(20%)	56	(33.9%)	0.000
8 years	140	(17%)	38	(27.1%)	
9 years	146	(17.7%)	44	(30.1%)	
10 years	132	(16%)	28	(21.2%)	
11 years	124	(15.0%)	20	(16.1%)	
12 years	118	(14.3%)	11	(9.3%)	

Regarding the prevalence of infection among students in the city centre of Misurata and its suburbs (rural areas), the infection rate was higher among students from the rural areas reaching 26.8%. This showed the correlation between the infection and over crowdedness in classrooms, as the rate was higher in the most crowded classroom

(with 30 students and more), where the infection rate was 26.9% as shown in table (3). The results of the statistical analysis showed that the difference was insignificant between the prevalence of infection and over crowdedness, as well as between the infection and residence.

Table 3:Correlation between the *Pediculus humanus capitis* and the students' residence and over crowdedness in classrooms.

Factor	Number of Samples		Number of Positive Samples		p- value
	Number	(%)	Number	(%)	
Residence					
City Centre	676	(81.9%)	157	(23.2%)	0.396
Suburbs (Rural areas)	149	(18.1%)	40	(26.8%)	
Over Crowdedness (Number of students in classroom)					
25-20	246	(29.8%)	51	(20.7%)	0.213
30-26	264	(32%)	61	(23.1%)	
31< -	315	(38.2%)	85	(26.9%)	

Some health practices such as sharinghair combs and personal towels and the frequency of hair washingper weekhave influenced the rate of infection. The findings in this study showed that the highest infection was associated with sharing towels and hair combs by 24.7%, and participants washing their hair twice a week revealed the highest rate of infection by 26.6% as shown in table (4). Following the statistical examination, the study revealed that there is no relationship between the infection with the *Pediculus humanus*

capitis and sharinghair combs and personal towels and the frequency of hair washing perweek.

As for the hair type, the study focused only on females as the highest rate of infection was among female students with short thick hair with a percentage of 35.8% as seen in table 4. The statistical analysis shows that there is no relationship between the *Pediculus humanus capitis* and hair type.

Table 4: Correlation between the *Pediculus humanus capitis* and some health practices and the hair type of female students.

Factor	Number of Samples		Number of Positive Samples		p- value
	Number	(%)	Number	(%)	
Sharing hair combs and personal towels					
Used personally	522	(63.3%)	122	(23.3%)	0.673
Shared with others	303	(36.7%)	75	(24.7%)	
Frequency of Hair Washing per Week					
Twice	236	(28.6%)	63	(26.6%)	0.105
Three times	366	(44.4%)	92	(1.25%)	
Four Times/more	223	(27%)	42	(18.8%)	
(Female's) Hair Type					
Long Thick	122	27.1%	40	(32.7%)	0.384
Long Light	110	24.4%	32	(29.0%)	
Short Thick	120	26.7%	43	(35.8%)	
Short Light	98	21.8%	25	(25.5%)	

3- The Role of Health Education in Minimising the Spread of *Pediculus humanus capitis* :

A comparison of the findings was conducted after the dissemination of the awareness and health education material to the students and following a second examination to detect the *Pediculus humanus capitis*. The study revealed, see table (9), that the infection rate was lower by (11.5%) than the one recorded following the first hair

examination. Based on the statistical analysis, the statistical significance was (P-value=0.000) which indicates that the health education has a significant role in reducing the prevalence of *Pediculus humanus capitis*.

Table 5: Comparison of findings following the health education and the second examination.

The Prevalence of <i>Pediculus humanus capitis</i> among students	Number of Samples	Number of Positive Samples	p-value
First Examination	825	197 (23.9%)	0.000
Second Examination	825	95 (11.5%)	

Discussion:

Even though *Pediculus humanus capitis* affect individuals in all age groups around the world, re-school children and school-age children have the highest prevalence of infection [11].

This study was conducted from November 2019 to February 2020 and was detected in 197 positive samples of 23.9% of the 825 selected primary school students in Misurata. Many studies have been conducted on this parasite, its prevalence rate, and its various effects in many countries. Nonetheless, such studies were very few in Libya including a study carried out in Misurata, by Elserite in 2016 [23], showing a completely different result, as it recorded an infection rate of 7.33%, if compared to the rate of infection revealed throughout the current study 23.9%. The reason behind this increase in the spread of *Pediculus humanus capitis* could be the migration of people from other Libyan cities to Misurata due to wars and poor living conditions. Other reasons could be the lack of periodic check programs of school children, and the lack of health awareness programs for families on the ways of prevention and on the importance of early detection of the infection. The infection rate in Al-Jufra city was 21.9% [4] while in Sabha, the rate was 38.6% [24].

This infection is spread worldwide as the infestation rate reached 3.4% in Turkey [25], 52% in Ukraine [26], 29.35% in Iran, [3], 26.6% in Jordan [8], (13.6%) in Mexico [27], 45.45% in Saudi Arabia [28], 65.7% in Ethiopia [29], and 19.9% in Peru [30].

This wide spread prevalence and the differences in the percentages of the of *Pediculus humanus capitis* can be attributed to many factors, including little or no interest in the problem of this disease, the difference in the size of the samples studied or the length of time each study was covered. Other factors such as the nature of the social traditions in different regions of the world and the difference in the living conditions have a clear effect in recording different rates of infection.

It is clear from table (2) that age was associated with *Pediculus humanus capitis*, with percentages higher at the age of 7 and 8 scoring a percentage of 33.9% and 27.1% respectively. In contrast, there were lower infection rates at the age groups of (11-12 years). This result was similar to the conclusions in other studies such as [6] which recorded a percentage of 42.7% and [4] with a percentage of 22.58%. The cause of the relatively high rates in these age groups (7 & 8) could be attributed to the direct contact among children while they are playing or studying together, and to the good relationship between girls at this age [31]. Another factor which may also play a role in reducing the spread of the *Pediculus humanus capitis* is the fact that most female students do not wear scarves at that early age. However, this research contradicted the outcomes of other studies where the age groups 9-11 showed the highest the infection rates [31] [29]. The reason behind this contradiction is that students at this age tend to be dependent on themselves rather than on their mothers in following personal hygiene behaviours assuming that they will be able to do so [32].

There was also a significant correlation between contracting the *Pediculus humanus capitis*, and the student's sex. The infection rate was higher among females 31.1% participants than that of males 15.2%. This finding was in accordance with those of most related studies. For example, a study conducted in Iran revealed that the infection rate among females was 6.66% compared to 2% among

male participants [33]. Another study in Mecca showed a prevalence rate of infection by 29.5% among females and 1.7% among males [31] while in Thailand the infection rate was 15.1% among females but no infection was recorded among males [34]. One factor that yield this high infection rates among females compared to those of males could be the length of girls' hair which provides the parasite with more favourable living conditions and hinders the detection of infection compared to males' short hair [35] [4]. Another factor is the difference in the behavioural patterns between boys and girls such as the close physical contact, especially the longer head contact between females [9] [28]. The difference in can also be due to the fact that female students wear scarves which delay the detection of *Pediculus* and increase the severity of the infection [31].

Although there are no statistically significant differences between the infection rates, hair type, and hygiene practices e.g., the frequency of washing one's hair and sharing combs and towels among family members, the current results showed a high rate among female students with short and thick hair, see table [4]. This is perhaps because of the *Pediculus* often living at a short distance from the scalp and hence it is not necessary that a long hair will reveal a high infection [31] [4]. This research also showed that the highest rate of infection was among participants who wash their hair less frequently during the week in addition to those who are often sharing their hair combs and towels with other family members, see table [4]. This increases the importance of personal hygiene, washing hair and maintaining personal use of hygiene tools. These conclusions were also similar to other studies such as [27] [28].

Over crowdedness in school classroom is another factor affecting the prevalence of the infection with the *Pediculus humanus capitis* among students, however, in our study this aspect was not statistically significant. The highest infection rate was more prevalent in the busiest classrooms, in which there is more physical and direct contact, a factor which was similarly highlighted in [27].

Another aspect discussed in this study is the correlation between the infection and the place of students' residence which was not of statistical importance either. Even though the number of participants selected from schools in rural areas was smaller than that of the schools in the city centre they revealed a higher rate of infection. These findings were also similar to other related studies such as [36] [35] [23]. The reason behind that could be the higher levels of health awareness at the urban areas [31] or the fact that urban schools having more concern for health supervisors or health educators [9]). This finding of the study, however, contradicts with what is found in the previous studies as in the study done in Mecca [31], where the highest rate of infection was higher in the city centre owing to the increased overcrowding and the closer contact among students.

The Role of Health Education in Minimising the Spread of the Disease.

The awareness and health education were statistically important in reducing the prevalence of infection ($P < 0.05$). Following the re-examination (after two months), the results showed a significant decrease in the infection rate from 23.9% to 11.5%. Consequently, it can be deduced that the effectiveness of the health education programmes is highly important in increasing knowledge and promoting the preventive practices aimed to reduce the prevalence of the *Pediculus humanus capitis* among school students. This result of

our study is in line with those of several other studies. Those studies similarly stressed that the health education programmes were effective in decreasing the infection rates from: 59% to 44%; in

Recommendations:

1- Awareness and health education programmes should be implemented and disseminated at the level of the whole society in general and at schools in particular because teachers play an important role in transferring information on the prevention and taking control of the disease.

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