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Original article

The Prevalence of *Pediculus capitis* Among Schoolchildren in Tripoli Area, Libya

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Abstract
Pediculus humanus capitis (Head louse) is an obligate ectoparasites that is transmitted from a person to another, through physical contact. Pediculosis is a health problem that is affects schoolchildren in all socio-economic levels. This survey is a descriptive, analytical study carried out to determine the prevalence rate of pediculosis capitis and some associated factors among primary schoolchildren in Tajura and Tripoli cities. The sample size was 4155 randomly selected schoolchildren in urban and rural schools. The survey was carried out for six months. A questionnaire that included questions relating to the age, hygiene, school grade, socio-economic status, parent's job, level of parent's education and family size was used. The results of the study showed that 169 schoolchildren (4.1 %) were infested. 0.6 % of the boys and 6.9 % of the girls were infested with head lice. The most prevalent rate was observed in student aged between 9-12 years and the lowest prevalence rate was observed in age group between 5-8 years. There were significant statistical differences between pediculosis capitis and some factors such as sex, level of parent's education, type of hair (length, colour and thickness), family size, girls wearing scarf and parent's job ($p<0.05$). The prevalence rate of head louse infestation in this study was high. The results of the present survey and others in foreign countries show that head louse infestation is a cosmopolitan health problem with different regional prevalence rates rendering it a considerable pediatric problem.
Keywords: Pediculosis, Prevalence, Tripoli, Libya.

Introduction

Infestations with parasites that live on or in the skin, namely ectoparasitoses, are usually considered to irritate trouble disorders. This infestation may affect a large proportion of a population. These can be sporadic, endemic, or epidemic. Pediculosis and scabies are ubiquitous [1]. The medical importance of *Pediculus* does not reside in its direct effects on the human host, but in its role as the vector of epidemic typhus and relapsing fever caused by *Ricketsia prowazekii* and *Borrelia recurrentis* respectively. Pathogens associated with *Pediculus* are transmitted less often through the direct bite of the lice [2].

Head lice (*Pediculus humanus capitis*) infestations are a common health problem mainly affecting schoolchildren aged between 3 and 12 years. Lice are blood-sucking insects (obligate parasite) that have no free-living stage in their life cycle [3]. Apart from these unpleasant results of louse infestation, the insect itself is a considerable disgust and shame, which unfortunately sometimes lead to infestations being hidden or denied. It also has social and psychological impact on infested children and their parents. Such an impact leads to restrain in seeking advice from healthcare providers, which leads to underestimation of the extent of the problem [2]. Lice (P. h. capitis) are wingless obligate ectoparasite of humans, which affect millions of children worldwide, especially those in the 5-11year age group and humans are the only known hosts of this specific parasite [4]. Like other insects of the suborder Anoplura, adult head lice are small (2.5–3 mm long), dorso-ventrally flattened, and entirely wingless [5]. The thoracic segments are fused, but otherwise distinct from the head and abdomen, the latter being composed of seven visible segments. Head lice are grey in general, but their precise color varies according to the environment in which they were raised. After feeding, consumed blood causes the louse body to take a reddish color [6].

The head louse (P. h. capitis) spends its entire life on human scalp and feed exclusively on human blood; humans are the only known hosts of this specific parasite. There are three stages in the life cycle of louse (eggs, nymph, and adults) with incomplete metamorphosis. In Tripoli and Tajoura area, Libya, there is a lack of studies about the prevalence and risk factors of head lice among schoolchildren. Therefore, the aim of this study is to estimate the prevalence of head lice in schoolchildren in Tripoli and Tajoura area, as well as to investigate the potential risk factors and the independent association between individual characteristics of the child, socio-economic status of the family and head lice.

Methods

Study design and setting

The study area is located in the northwest Mediterranean coast of the Libya, and divided into two regions: Tripoli area (an urban area) and Tajura community (suburban area). The study area is based on comparative socio-demographic and ecological characteristics.

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Data collection procedure

A questionnaire was used and the data from the physical examination were recorded for each pupil along with the demographic and socio-economic information about age, sex, hair type, hygiene, girls wearing scarf, residency, family size, housing, number of rooms, family history and possible relapses.

The total number of schools included in the current study were 24 (governmental and private) schools. Among these schools 16 (10 governmental and 6 private) were located in Tripoli area and 8 (governmental) were located in Tajura area.

The total number of study samples 4850 schoolchildren were identified randomly. Only 4155 out 4850 were collected as the others that were not returned, with age range from five to fourteen years old. All grades, 1-6, of primary school children were screened for head louse infestation.

Specially trained school health nurses helped us in examining the children's hair and scalp for lice. The entire head was examined carefully although special attention was paid to the nape of the head and behind the ears. The screening is achieved by examination of the scalp looking for lice and nits (eggs) on the hair by hand separation of the hair every 1-2 cm. Child was considered as positive if there is evidence of head lice or nymphs and presence of live or dead nits regardless of morphologic features.

Statistical analysis

Obtained data was entered to SPSS data sheets and based on study questions, which were analysed using statistical tests and parameters, where the statistical significance was defined as ($P<0.05$) (SPSS software, version 11.5, Chicago, IL, USA, 2002).

Results

The sample size was 4155 students (1872 males and 2283 females) with age range from 5-14 years old.

All schools showed infestation with head lice, there were eight governmental schools of Tajura area that showed high prevalence rate of head lice infestation (4.8 %). In Tripoli there were sixteen governmental and private schools with prevalence rate of head lice infestation (3.5 %). The results (Table 1) showed there was significant difference between prevalence rates of head lice among schools of both areas Tripoli and Tajura ($P = 0.046$).

Table 1. Prevalence of head lice infestation in schools of Tripoli and Tajura

School	Infected		Total
	Negative	Positive	
Tripoli area	2290 96.5%	84 3.5%	2374 100%
Tajura area	1696 95.2%	85 4.8%	1781 100%
Total	3986 95.9%	169 4.1%	4155 100%

The total number of students are 4155 that were 3673 of them in governmental schools and 4.3 % of those were infested. Whereas 482 of them in private schools and 2.5 % of them were infested. The result showed (Table 2) was no significant difference between governmental and private schools (p. value = 0.062).

Table 2. Prevalence of head lice infestation in governmental and private schools.

Types of Schools	Infected		Total
	Negative	Positive	
Governmental Schools	3516 95.7%	157 4.3%	3673 100%
Private Schools	470 97.5%	12 2.5%	482 100%
Total	3986 95.9%	169 4.1%	4155 100%

Figure 1 shows the prevalence of pediculosis in different age groups in this study. Even though, the results showed the infestation rate was high in age group 9 to 12 years (4.9 %) and low in age group 5 to 8 years (2.8 %), there was significant difference found in the prevalence rate between age groups of total area (P. value 0.003). However, the head lice detected in males were 0.6 % and females were 6.9 %. The correlation factor between sex and infestation, since P. value = 0.000, means that there is significant relationship. Nevertheless, there is a family size effect on the infestation that showed as family size of 5 to 10 members was the highest (4.7 %), while lowest (2.7 %) was in family size less than 5 members, with P. value = 0.009. In addition, our findings showed that monthly family income has no significant (P. value = 0.106) on the

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prevalence of infestation. In addition, the infestation factors in schoolchildren decreases when the level of education increases with significant difference in father's (P. value = 0.014) and mother's (P. value = 0.051) education

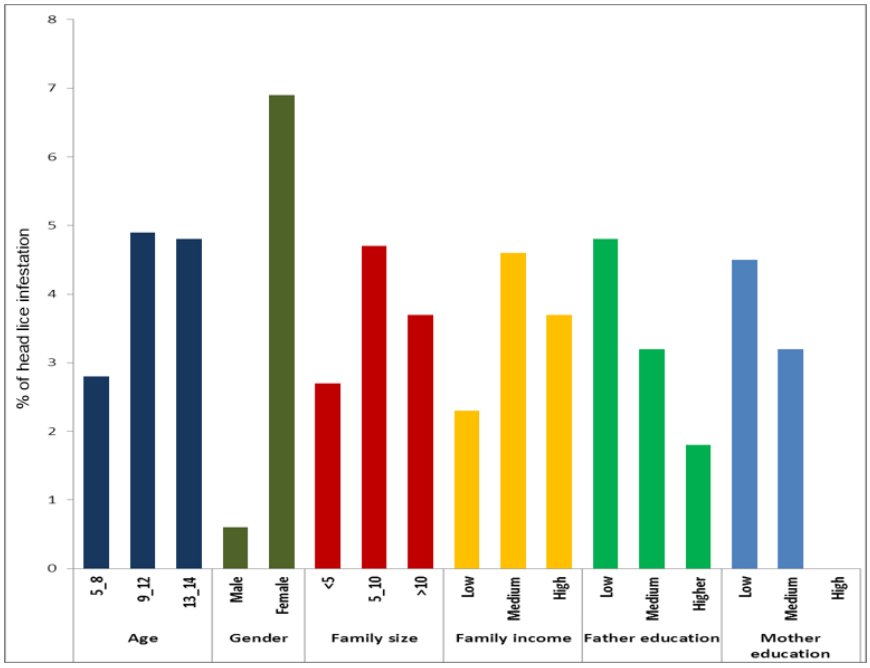

Figure 1. Percentage of head lice infestation in relation to age groups, gender, family size, family income and parents' education. * Low education: (Primary, preparatory and secondary level); Medium education: (university and institute graduates); High education: (Master and PhD degree).

Figure 2 shows the Prevalence of head lice infestation in according to length, thickness and color of hair. It was significant relationship between the length of hair and infestation, 7.1 % in the children with longer hair while shorter hair only 0.4 %. (p. value < 0.000). Although, there is a weak relationship between the thickness of hair and infestation, the total number of students with dense hair were 3.8 %, while the others with rare hair were 5.8% (P. value = 0.022). Nevertheless, hair colors show that the highest effect was on the children with yellow hair (10.0%), while the lowest effect was on children with red hair (0%), since the p. value = 0.002.

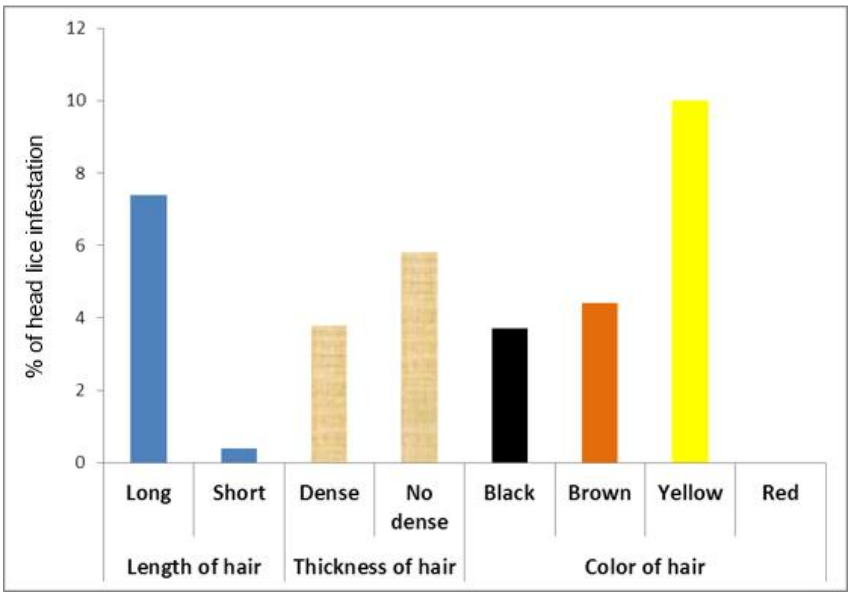

Figure 2. Percentage of head lice infestation in relation to length, thickness and color of hair.

Table 3 exhibits strong relationship between scarf wear and infestation, since the P. value = 0 another important cultural factor is that a very high percentage of the girls in Libya wear a head cover because of their Islamic religion. The number of students infested is 10.3% for those wearing scarf 5.8% and who not wearing scarf.

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Table 3. Prevalence of head lice infestation in schoolchildren (girls) wearing of scarf.

Wearing of scarf	Infected		Total
	Negative	Positive	
Yes	512 89.7%	59 10.3%	571 100%
No	1613 94.2%	99 5.8%	1712 100%
Total	2125 93.1%	158 6.9%	2283 100%

The results in table 4 show there was high significant difference between those whom washing hair once per week and 7 time per week (p. value = 0.000).

Table 4. Prevalence of head lice infestation in relation to hygiene and frequency of bathing per week.

Factors	Presence of lice or nits				Total (4155)	P. value
	Negative		Positive			
	No.	%	No.	%		
Hygiene						
Bad	200	69.9	86	30.1	286	0.000
Good	3786	97.9	83	2.1	3869	
Hair washing per week						
1 Time	896	95.2	45	4.8	941	0.000
2 Times	1022	93.1	76	6.9	1098	
3 Times	1472	97	45	3	1517	
4 Times	245	99.2	2	0.8	247	
5 Times	60	100	0	0	60	
6 Times	4	100	0	0	4	
7 Times	287	99.7	1	0.3	288	

Figure 3 showed that using shared belongings (clothing and brushes), sharing bedrooms and head contact, animal contact at home or farm, and Libyan or non-Libyan children, that there was no statistical signific difference between the prevalence of head lice and those factors. On the other hand, there was statistically significant difference between the prevalence rates of children who lived in different type of houses with the highest infestation in those who lived in flats (4.9%).

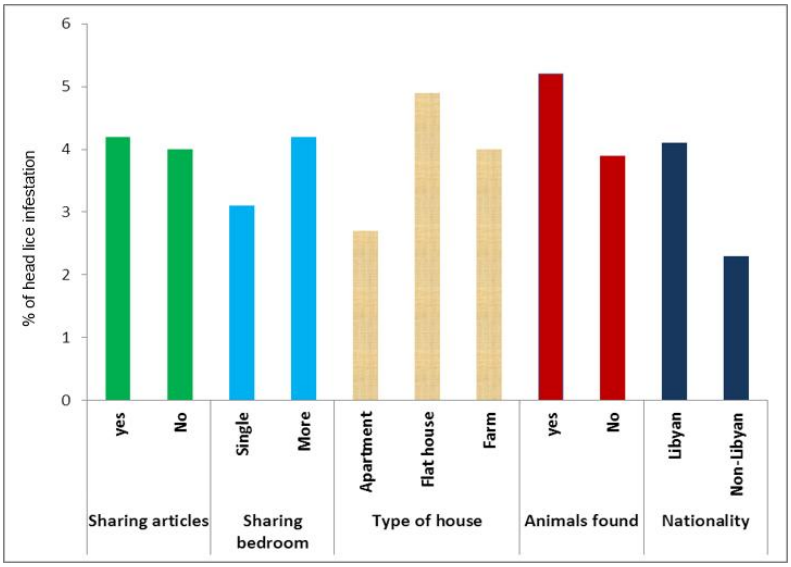

Figure 3. Percentage of head lice infestation in relation to sharing articles, bedrooms, type of house, animal contact and nationality.

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Discussion

Pediculosis is caused by ectoparasites. Pruritus is the most common presenting symptom that may lead to severe secondary bacterial infections. Pediculosis is a common public health problem and may also detrimentally influence schoolchildren's learning performance by negatively affecting concentration or through stigmatization following detection. In the current study, the prevalence of lice infestations was ranged from 1.2 - 4.9 %, which disagree with the results obtained by another author Falagas [7], who found that levels of lice infestations, ranged from 1.6 - 87%. Also, the result disagrees with study performed in Libya Bharija et al. [8], who found that infestations were 78.6%. However; our results agree more or less with other studies in Turkey [9], Jordan [10], Gaza [11] and Egypt [12]. These variations in prevalence rate may be due to sociodemographic and economic factors such as overcrowding, hair characteristics and poor hygiene. The variation of infestation rate between the studied areas may be due to several factors including the eradication methods (such as head shaving), number of head-to-head contacts, diagnostic techniques, school head lice policy, pesticide resistance, and knowledge regarding head lice, [7,13].

The results showed significant difference in prevalence rates of head lice as the Tajura schools were higher than Tripoli. This may be attributed to the differences in cultural level of the families living in both areas. These results disagree with those obtained by Pollack [14] in his opinion the lice do not respect socio-economic class distinctions, i.e., direct no relation socio economic conditions with pediculosis. However, the current results agree with those of Gulati et al. [15], who worked in Goa (India), and Bharija et al. [8] who worked in Libya, and Kazmi et al. [16], who worked in Lahore (Pakistan), also agree with Davarpanah et al. [17], and Moosazadeh et al., [18], in Iran; they considered poor socioeconomic conditions as the major contributing source of pediculosis.

Prevalence of head lice infestation in relation to type of schools (governmental or private) showed no significant difference. This suggests that the prevalence of lice in schools is due to lack of information about general hygiene. Studying the influence of sex on head infestation rate the results showed that the infestation rate was higher in girls than in boys and this was consistent with many other studies, [8,19-23]. A clear preponderance among girls is related to the behavioral differences between sexes. Boys have tendency only to brief contact during sports or rough activities, while girls more contaminated than boys [18], they have closer, prolonged and closer head contacts in small groups [24]. Also, it may be attributed to the fact that female children have long and thick hair and that can probably be considered as an important transmitting factor, as head lice need specific conditions to move from one head to another, which occurs more frequently in longer hair [12,18,25-29]. Even though, shaving the scalp was effective, if stigmatizing, control method.

The effect of wearing of veil (head cover) for female students was illustrated in this study and the results showed positive correlation. The transmission of head lice should be less likely since their heads were covered. On the other hand, covering head might facilitate the infestation by creating better and ideal scalp humidity and temperature for the head lice to thrive and multiply. Moderate temperature and humidity are required for hatching which explains why head lice are more prevalent over summer, since most eggs hatch after seven to 10 days to be mature [30].

Furthermore, most Muslim girls cover their head only in public but not at home thus, transmission may still occur. This was not mentioned by previous studies except by Firoozfar et al. [31] who reported there was no significant difference between lice infestation and permanent scarf coverings at home, but in this study, we noted the way of wearing scarf have problem, because they wear it without cleaning.

Concerning the age variation in this study, the highest rate of infestation was noticed among children age group of more than 9-12 years compared to other lower or higher age groups. Other studies also found some significant variations in the rate of parasite infestation between different age groups [8,11,26,32]. According to United States Centres for Disease Control and Prevention, it was estimated that between 6-12 million cases of head lice infestation occur each year in children between 3-11 years of age [33]. The higher rate of pediculosis among this age group could be explained partially, as this particular age occurs between the younger ages of a complete dependence on parents and guardians for combing and washing or cleaning their hair which helps in early detection of infestation before its establishment, and the older ages of nearly complete independence from parents which were accompanied by increasing knowledge and awareness of the surrounding environmental factors. Another study with similar results in Ardabil reported that infestation rate in younger age group was more than the older age group [34]. It seems that there is a relation between the age and the infestation since some age the school children will take care of themselves.

The hair characters and the prevalence of infestation of pediculosis are highly controversial. In this study, it was found that the highest rate was among those with yellow hairs in both genders compared to other hair colors. Dissimilar, with the case of other studies where, they found that the highest rate was among those with black color hair [25,29,35]. One can assume that brown-colored lice contrast more in fair, red and black hair and are therefore detected earlier. Nevertheless, the comparison wasn't fair as some hair characters are rare among the Libyan population (colored hairs) which creates a non-equivalence state among the sample sizes of different groups.

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The effect of cleanliness level on prevalence of head lice infestation was investigated and the results proved that, the cleanliness is very important and head lice were identified in 30.1% of dirty children and only 2.1% of clean children. It was clear from the present results that prevalence of the infestation was significantly associated with the frequency of hair wash. The results showed that there was high significant difference between who wash their hair 1 time and 7 times per week, which is a very important indicator to our research since the cleanliness and frequency of hair wash is essential to schoolchildren. This also, agrees with some authors Al-Bashtawy and Hasna [28]. Other authors Ali & Ramzan [36]; AL-Shawa [37]; (Moosazadeh et al. [18] found the relation only significant between infestation and hair wash.

The effects of family size on the infestation rate showed a direct association between infestation and number of family members. In family size of < 5 members the infestation rate was 2.7%, while in family size of 5 to 10 members the infestation rate was 4.7%. However, family size greater than >10 members showed prevalence rate of 3.7%, which consistent with Balcioglu et al. [38] and El Magrabi et al. [12]. This may be possible because children in large families have higher risk of being infested by their siblings (or parents). Students with many brothers and affected family members were significantly associated with head lice infestation [23]. This was supported by a study in which 48.9% of the repeated reinfested pupils originated from families with four or more children. Close contact between siblings and an overcrowded home facilitates the transmission of head lice, especially if there have another affected family member [39].

Prevalence of head lice infestation in relation to children parents' education levels, proved that head lice infestation is inversely proportional to the educational level of child's mother and father and increasing child's mother's and father's educational levels leads to decreasing head lice infestation rate. This study confirms that the results of other studies [18,23,26,37,40,41]. In contrast with the result of El Magrabi et al. [12].

In this study, showed no significant effects on prevalence rates of head lice infestation with family income which disagrees with Bachok et al. [27]; Al-Shawa [37]; Mahmood [29]; Al-Bashtawy and Hasna [28] who found that pupils from very low family income. Also, similar results, no correlation was found between lice infestation and sharing articles (including brushes and clothes) that disagree with others, Al-Shawa [37]; AlBashtawy and Hasna [28]; Motevalli-Haghi et al. [42] and El Magrabi et al. [12] who found that the pediculosis is highest in family members with increasing contact. Nevertheless, our results indicate that the school children infested with head lice did not share beds, which agrees with Magalhaes et al. [43]. Conversely, the current results disagree with some authors Ali & Ramzan [36]; Motevalli-Haghi et al. [42]; (El Magrabi et al. [12] suggesting that transmission may have been more via social contact at home or at school.

Conclusion

The present study among primary schoolchildren in Tajura and Tripoli cities in Libya demonstrated that significant differences occur between prevalen rates of pediculosis infestation in relation to wearing of scarf and type of house (apartment, flat or farm). Other factors such as presence of domestic animals in houses, nationality of children and type of school have no significant effects on prevalence rates. The prevalence rate of head lice infestation among the five studied areas indicated that there is relationship between areas and the infestation and a significant difference between prevalence rates of head lice among schools of both areas Tripoli and Tajura

Conflicts of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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المستخلص

يعتبر قمل من الطفيليات الخارجية الذي تنتقل من شخص إلى أخر عن طريق الاتصال الجسدي. القمل يمثل مشكلة صحية تؤثر على أطفال المدارس بجميع المستويات الاجتماعية والاقتصادية. هذا المسح عبارة عن دراسة وصفية تحليلية أجريت لتحديد معدل انتشار قمل الرأس وبعض العوامل المرتبطة به بين أطفال المدارس الابتدائية في مدينتي تاجوراء وطرابلس. تم اختيارالطلبة عشوائياً في المدارس الحضرية والريفية، وبلغ حجم العينة 4155 تلميذاً. تم إجراء الاستطلاع لمدة 6 شهور. حيث استخدام استبيان يتضمن أسئلة تتعلق بالعمر، والنظافة، والصف الدراسي، والحالة الاجتماعية والاقتصادية، ووظيفة الوالدين، ومستوى تعليم الوالدين، وحجم الأسرة. أظهرت نتائج هذه الدراسة أن 169 تلميذاً (4.1%) أصيبوا بالمرض. وكان 0.6% من الأولاد و6.9% من البنات مصابين بقمل الرأس. ولوحظ أن معدل الانتشار كان أكثر لدى الطلاب الذين تتراوح أعمارهم بين 9-12 سنة، ولوحظ أدنى معدل انتشار في الفئة العمرية بين 5-8 سنوات. كانت هناك فروق ذات دلالة إحصائية (P <0.05) بين قمل الرأس وبعض العوامل مثل الجنس، ومستوى تعليم الوالدين، ونوع الشعر (الطول واللون والسمك)، وعدد أفراد الأسرة، وارتداء الفتيات للوشاح، ووظيفة الوالدين. أستنتج ان معدل انتشار الإصابة بقمل الرأس في هذه الدراسة مرتفعا. تظهر نتائج المسح الحالي ومسح آخر في بلدان أجنبية أن الإصابة بقمل الرأس هي مشكلة صحية عالمية مع اختلاف معدلات الانتشار الإقليمية مما يجعلها مشكلة كبيرة للأطفال.

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