



Prevalence of head lice, *Pediculus humanus capitis* L. and their relation to anxiety among primary school children in Kalar district, Kurdistan region-Iraq

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Abstract

Head lice, *Pediculus humanus capitis* De Geer infestation is one of the most important health problems throughout the world. The aim of the current study was to estimate the prevalence of head lice among local primary school children in Kalar district-Kurdistan, Iraq and find out the relationship between head lice infestation and anxiety. During the period October 2018 to May 2019, an overall 8847 primary school children aged (6-11 years) were randomly selected from (22) primary schools and examined for the presence of head lice using lice comb and magnifying lenses. Results of the current study revealed the existence of 1277 cases (14.43%) of infestation with *P. humanus capitis*. The rate of infection in girls was significantly higher than boys $P < 0.05$. Schools of the center of Kalar had higher prevalence rate than those of the sub-districts. The highest rate of infection was observed among children aged 10-11 years while the lowest rate was observed in the younger children 6-7 years. Variations in infection rates were observed in the different investigated schools. There was a great correlation between number of students in class and infection rate $P < 0.05$. In addition, the study showed relationship between head lice and anxiety. Accordingly, 66 % of the infested children had moderate anxiety. Findings of this study suggest that head lice infestation is within the epidemic level in Kalar.

Introduction

1 Three divergent clades of lice can infest human: Head lice, body lice and pubic lice (Amin and Ameen, 2018). The human head louse, *Pediculus humanus* Var. *capitis* De Geer, 1778, is a wingless, blood feeding parasitic insect of human that affect millions of people in different ages particularly children in all over the world (Doroodgar *et*

al., 2011). Head lice are more prevalent in the developing countries especially in the crowded places with low socio-economic and poor hygiene conditions (Akhter *et al.*, 2010). *Pediculus humanus capitis* lives on the human scalp where it attaches to the hair shafts, nourish on blood and complete all the stages of its life cycle: egg, nymph and adult

(Meister and Ochsendorf, 2016). Head lice do not fly or jump, rather transmit from infested person to intact ones through direct head to head contact or less frequently indirectly via sharing combs, clothes, towels and blankets and other belongings (Devore *et al.*, 2015). Head lice are not considered to be source of pathogen transmission, however, the parasite saliva and fecal antigen cause severe pruritus and sensitization of the scalp (Wooltorton, 2003). Secondary bacterial infection at the bite site is considered as common complication especially during constant infestations (Mazurek and Lee, 2000), and in very severe infestation, head lice may cause anemia (Guss *et al.*, 2011). There are other studies carried out on head lice in Iraq and the prevalence of the parasite varies according to locations, time of the study, age and sex of the hosts (Al-Alousi and Tawfeeq, 2007; Hamad, 2012; Al-Marjan and Kamil, 2014; Suleiman and Magar, 2014; Obaid, 2018). The psychological impacts of head lice on children are not well studied. Sleeping disturbance, itching, restlessness, depression, attention deficit in the class, insomnia, lack of social status and psychological stress caused by stigmatization by peers are all factors expected to cause anxiety which might indirectly affect the learning performance of children and eventually result in educational failure (Mumcuoglu, 1991; Andrews and Wilding, 2004; Tebruegge *et al.*, 2011; Devore and Schutze 2015). The current study aimed to investigate the prevalence of *P. humanus capitis* in children from primary schools in Kalar district and their relation with anxiety of children.

Materials and Methods

A sample of 8847 primary school children from 22 primary schools in Kalar district and two sub-districts (Rizgari and Girdagozina), Kurdistan region of Iraq were investigated for the prevalence of head lice, *Pediculus humanus capitis* (Figure 1).



Figure 1: Study area, Kalar-Kurdistan region, Iraq

The children aged 6-11 years and consisted of (4410) boys and (4437) girls. The screening for the parasites was carried out by using fine-toothed combs and visual inspection of the scalp was performed to find adult lice, nymph and eggs (Khidhir *et al.*, 2017). A questionnaire form was filled out about different variables of the children such as age, sex, number of children in class, hair color, hair type, hair length, method of transportation, and number of family members. To study anxiety in children, a questionnaire form was developed based on the literature review and (GAD 7) scales for measuring Anxiety among youth (Spitzer *et al.*, 2006; Muris *et al.*, 2017). Then, the questionnaire was shown to five university professors in the area of education and psychology. After receiving experts' feedback, the final version of the questionnaire was randomly distributed over 859 primary school children who were infested with head lice. Parents of the children filled the questionnaires. The questionnaire had items on indicators of variables to demand the opinion of participants. The statements formed questionnaire created answers, which were tabulated on four scales, consisting of not at all, several days, more than half days and nearly every day. Cronbach's Alpha was used to examine the reliability of the

questionnaire. It resulted in 0.806, which is very acceptable. Variables of the study were statistically analyzed using Graphpad prism software version 6.1. The differences between variables were considered significant at 5% level of significance ($p < 0.05$).

Results

The overall prevalence of head lice infestation among school children in this study was 14.43% (1277/8847) and was significantly higher in girls 24% (1065/4437) $p < 0.05$ than boys 4.8% (212/4410). The highest rate of infection was observed in children aged 10-11 years (23.35%), while the lowest prevalence of the parasite was observed in children aged 6-7 years (8.73%), and there was a significant differences between infection rates among the different age groups $p < 0.05$. Infections were recorded in all the 22 investigated schools, the highest rate of infection was observed in Shakal school 44.44% while the lowest was in Ashna 4.72% and there was a significant difference between infection rates in the studied schools $p < 0.05$. There was a significant correlation between student number in class and infection rate $p < 0.05$. Infection rate was significantly higher in Kalar center (15.44%) in compare to that of the sub-districts (13.56%) $p < 0.05$. The result of the study showed that 66 % of the infested children had moderate anxiety. There was also a significant difference between gender and level of anxiety. However, no significant difference was observed between level of anxiety and age groups.

Table 1: Prevalence of head lice in boys and girls of primary schools in Kalar district

Gender	Examined children	Infected children	Infection rate %
Boys	4410	212	4.8
Girls	4437	1065	24
Total	8847	1277	14.43

P=0.0001

Table 2: Prevalence of head lice among primary schoolchildren in Kalar district according to age groups

Age groups	Samples examined	No. infected	Infection rate %
6-7 years	3010	263	8.73
8-9 years	2943	338	11.48
10-11 years	2894	676	23.35

P=0.0001

Table 3: Prevalence of head lice in school children in Kalar and its sub-districts

Location of school	Examined children	Infected children	Infection rate %
Kalar center	4040	624	15.44
Sub-districts	4807	652	13.56

P=0.0132

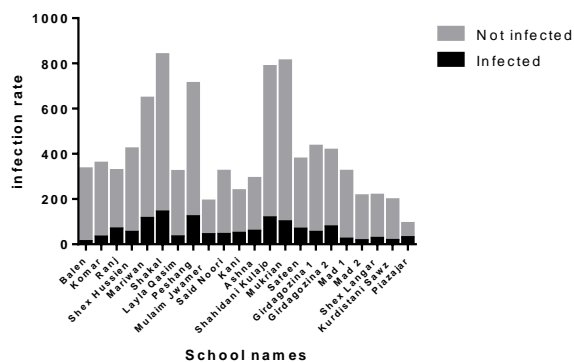


Figure 2: Infection rates with head lice in different primary schools in Kalar and other sub-districts

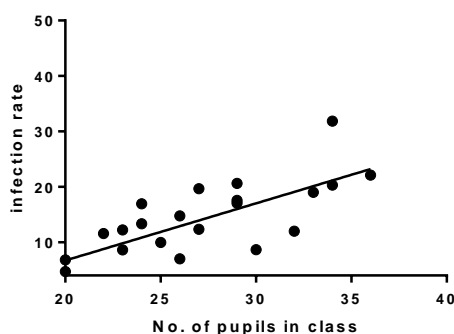


Figure 3: Correlation between number of students in class and infection rate

Table 4: Reliability of the study questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.804	0.806	7

Table 5: Levels of anxiety among infested children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Minimal anxiety	281	32.7	32.7	32.7
	Moderate anxiety	569	66.2	66.2	99.0
	Sever anxiety	9	1.0	1.0	100.0
	Total	859	100.0	100.0	

Table 6: Correlations between gender and levels of anxiety

Gender	Level of anxiety			Total
	Minimal anxiety	Moderate anxiety	Severe anxiety	
Male	33	102	0	135
Female	248	467	9	724
	P=0.0284			859

Table 7: Correlation between age groups and levels of anxiety

Age groups	Level of anxiety			Total
	Minimal anxiety	Moderate anxiety	Severe anxiety	
6-7 years	58	134	2	194
8-9 years	63	155	3	221
10-11 years	160	280	4	444
Total	281	569	9	859
	P=0.3002			

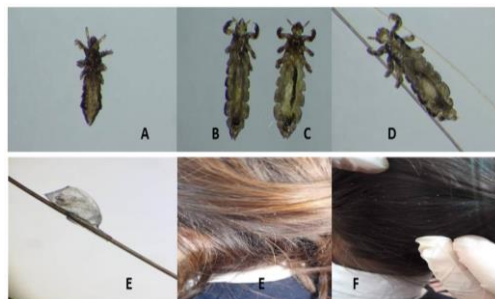


Figure 4: Morphological views of the different stages of head lice *P. humanus capitis* and infestation sites. A- Dorsal view of nymph, B- Ventral view of adult female, C- Ventral view of adult male, D- Male head lice attached to human hair shaft, E-Egg (Nits) of head lice, D,E infested children with adults and nymphs of head lice.

Discussion

In the present study, we investigated (22) primary schools in Kalar district and two subdistricts: Rizgari and Girdagozina to study the prevalence of head lice *P. humanus capitis* among primary school children. An overall 8847 children were investigated for head lice infestation and the rate of infestation was 14.43%. National pediculosis association of USA defines pediculosis as epidemic when the rate of infestation is greater than 5% (Rassami and Soonwera, 2012). Head lice are cosmopolitan which infest children and adults in all over the world. In the Americas, most of the studies are carried out in the South American countries. However, it is estimated that 6-12 million children between the ages of 3-11 become infested with head lice each year in the US (CDC, 2015). In Brazil, the prevalence of head lice in school children and day-care centers was 18.5% (Borges-Moroni *et al.*, 2011). Higher rate (29.7%) was reported in Argentina when 1856 elementary school children aged 3-13 were screened for head lice (Tolozza *et al.*, 2009). In Nigeria, Okoh and Alikor (2013) carried out a similar study and the prevalence of head lice was very low (0.7%) compared to the current study. However, in Egypt the rate of infestation in primary school children was 33% using

dermoscopic examination (El-Sayed *et al.*, 2017). In Australia the prevalence of head lice was 13% (Counahan *et al.*, 2004). In Turkey, two studies were carried out on primary school children in Sivas and Kayseri and the prevalence of head lice were 6% and 13.1% respectively (Deg̃erli *et al.*, 2012; Gulgun *et al.*, 2013). In Iran which is the closest non-Iraqi area to Garmian region, the prevalence of head lice in primary school children varies from 0.47% to 67.3% (Doroodgar *et al.*, 2011; Soleimani-Ahmadi *et al.*, 2017). In Iraq, during the last 15 years there are noticeable studies carried out on the prevalence of head lice, the biology and methods of prevention and control of the parasite and various infection rates have been reported. Mahmood (2010) investigated children from 10 primary school aged 6-12 years in the Iraqi capital Baghdad, the researcher reported prevalence of 13.5%. Earlier in Nassirya Province lower prevalence of head lice was reported among primary school children 7.2% (Al-Aboody, 2008). In Mosul, pupils from 24 primary schools were screened for head lice; it was found that 33.2% of the children were infested with the parasite (Al-Abaddy, 2008). In Najaf and Erbil, head lice infestation was close to the findings of the present study 14% and 14.52% (Khidhir *et al.*, 2017; Salih *et al.*, 2017). In Diyala, higher rate was reported 24% compared to ours when primary school children from three areas of the governorate (Baquba, Buhrz and Baladroz) were investigated for infestation with the parasite (Salih, 2010).

In the current study the infection rate with head lice was significantly greater in girls compared to boys. This finding is in agreement with those of most of the literature reported in Iraq and the world (Counahan *et al.*, 2004; Toloza *et al.*, 2009; Al-Marjan and kamil, 2014; Suleiman and Magar, 2014). The main reason for the higher lice rate in girls is the presence of dense and long hair which provides a better shelter for the parasite to climb without being easily noticed (Khidhir *et*

al., 2017). The higher infestation rate was observed in in the age group 10-11 in the current study compared to the younger groups 6-7 and 8-9 years. This is in accordance with the studies of (Borges-Moroni *et al.*, 2011; El-Sayed *et al.*, 2017). However, other researchers have reported that younger children particularly the age 6-7 are more infested than older children (Salih, 2010; Khidhir *et al.*, 2017). The reason for the higher prevalence of infestation in older children in the present study could be due to that children at this age are more self-dependent in contrast to the younger children who depend on their parents particularly at bath time. Prevalence of head lice varied significantly from school to school in the current study. The reason for this variation is due to the variation in parental and health advisors care and control strategies applied in different areas (Toloza *et al.*, 2009). Lice infestation had direct relationship with the number of student in class. The reason for that is attributed to that crowded classes minimize the distance between pupils and during class activities there is higher physical contact between children, hence increasing the prevalence rate (Gharsan *et al.*, 2016).

Previously, head lice were a hygiene issue mainly linked to students from a low socioeconomic background. Nowadays, head lice are observed among students from all socioeconomic status. Head lice cause different stigmas among students. Parents and children are ashamed and experience high level of anxiety when they realize themselves or their children are infested with head lice (Mumcuoglu, 1999; Devore and Schutze, 2015; Lacarrubba *et al.*, 2019). Therefore, the other main purpose of this study was to determine the possible psychological effects such as anxiety caused by head lice on the infested pupils. The results of the present study showed that 66 % of the school children, who had head lice, experienced moderate anxiety. The findings of this study align with Mumcuoglu's study. While, the outcome of

head lice is significant for everyone, it is more dangerous in children. According to Mumcuohlu, head lice in kindergarten children was associated with fear and anxiety (1991). In addition, the American Academy of Pediatrics reported that majority of the school age children who have head lice suffer from high level of anxiety (Devore and Schutze 2015). Anxiety is a psychological disorder that affects individual's life dramatically. Previous research reported that the prevalence of anxiety among girls is higher than boys (Gater *et al.*, 1998). A person with anxiety is described as "predisposed to experiencing excessive fear and/or anxiety responses to perceived threats in a way that leads to significant distress and impairment in functioning" (Craske and Stein, 2016). Finding the relationship between anxiety and students' performance has been the focus of the researchers. Results of previous studies have shown that anxiety has a direct impact on the students' academic performance at school (Andrews and Wilding, 2004). Students who experience anxiety perform poorly in academic tasks.

Although there are several factors that affect anxiety levels, fear is one of the fundamental elements of all the anxiety disorders (Clark and Beck, 2011). Parents of the students who have participated by filling out the questionnaire indicated that their children fear being exposed for having head lice. In other words, students who had ever been infected with head lice could be subject of Bullying (Tebruegge *et al.*, 2011). Finding the relationship between gender and level of the anxiety was another objective of this study. The results of the current study showed that there was a significant difference between gender and level of anxiety. Essentially, several researches have stated that girls are more prone to experience anxiety than their boy counterparts (Toufexis *et al.*, 2006; Lewinsohn *et al.*, 1998; McLean *et al.*, 2011; Park and French, 2013).

Finally, the current research attempted to investigate the relationship between the level of anxiety and the student's age group. The statistical findings of this study demonstrated no significant relationship between level of anxiety and age groups. On the other hand, results of numerous studies suggest that there is a relationship between age-group and anxiety disorder. Reportedly, "older persons have significantly lower frequencies of any current anxiety disorder and any lifetime anxiety disorder, even after controlling for relevant demographic and clinical variables" (Flint *et al.*, 2010). Similarly, Byers *et al.* (2010) stated that with age anxiety generally starts to decline. The absence of significant relationship between level of anxiety and age groups in the present study could be because the range of age groups were very close to each other, (6-7,8-9,10-11) years old.

Conclusions

The present study concludes that head lice are common in primary school children of Kalar district to the epidemic level. They infect both genders with higher rate in girls than boys. Some schools have high rate of infection than others. Children aged 10-11 more frequently carry the parasite. The more crowded the places the higher rate of infection is expected. In addition, the findings of the study showed that majority of the infested children experience moderate anxiety. It is therefore, better care is required from health directorate, school administrations and parents to minimize the rate of infestation.

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