

## Original Article

## The Prevalence of *Pediculus Capitis* and Personal Hygiene Status in Two Vocational High Schools

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### Abstract

**Aim:** *Pediculus capitis* (*P. capitis*) is a prevalent contagious parasitosis disease worldwide. It is a serious public health problem because of its high prevalence in school-age children. This study was planned to determine the prevalence of *P. capitis* and the personal hygiene status of the students in different vocational high schools.

**Methods:** The data were collected from 491 high school students using a Personal Hygiene Questionnaire between September-December 2018 and by the screening of *P. capitis*.

**Results:** *P. capitis* was detected in 51.9% of the cases. The prevalence of pediculosis was higher in the female children (236/491) than that in the male children (19/491). This difference was found to be significant according to gender ( $p < 0.001$ ). There was a statistically significant difference between the schools in terms of pediculosis prevalence according to the status of washing hands before meals and cutting nails ( $p < 0.05$ ). There was a significant difference between the children's *P. capitis* positivity according to their level of knowledge about *P. capitis* ( $p < 0.05$ ).

**Conclusion:** *P. capitis* remains a prevalent endemic problem in school-age children in Turkey. Providing education in schools, raising awareness of parents and ensuring cooperation will contribute to the decrease of *P. capitis* endemics.

**Keywords:** *Pediculus capitis*, school-age child, prevalence, personal hygiene

### Introduction

Pediculosis capitis (hair louse) is a contagious infectious disease formed due to lack of personal hygiene. It leads to serious epidemics in school-age children worldwide. Pediculosis capitis (*P. Capitis*) is an ectoparasite that causes infestation by sucking blood from the skin at the back of the head, particularly in the occipital and temporal region (Basarslan et al., 2014). *P. Capitis* has 3 stages: egg, nymph, and adult. Females of this parasite are larger compared to males. Female *P. Capitis* can produce up to 100 eggs (nits) throughout their lives. Nits easily adhere to the hair of the host with an adhesive agent which is secreted by the female parasite (Karaman et al.,

2017). The main complaint among individuals with a parasitic infestation is the presence of itching. Due to itching, skin redness and papular lesions may develop. Infestation may also cause secondary infections such as impetigo and furunculosis (Kaya et al., 2017; Ozbek, 2017).

The prevalence of Pediculosis capitis (*P. Capitis*) in school-age children is between 5% and 80% (Frankowski & Bocchini, 2010; Albashtawy & Hasna, 2012) across the world and between 1% and 34.1% (Daldal et al., 2004; Payzin, 1995) in our country. The highest *P. Capitis* incidence is among girl children aged 5-12 years (Dursun & Cengiz, 2010; Balcioglu et al., 2012; Ozbek, 2017). Factors that affect the prevalence of this

parasite, which is as old as human history, are reported as climate, geographic situation, socio-demographic structure, cultural factors, hygienic conditions, and poor personal hygiene (Khamaiseh, 2018). *P. capitis* is a contagious parasitic disease, of which the prevalence is higher in the winter months and in crowded places such as schools, prisons, barracks, and dormitories (Akkas & Cengiz, 2011). The spread of the parasite is mostly seen in cases such as close contact and sharing bed sheets, hair combs, hats, pillowcases and clothes (Karaman et al., 2014; Ismail, Kabakibi & Al- Kafri, 2018).

Insufficient knowledge and behaviors of children on hygiene, insufficient preventive measures at school and at home highly complicate the management of *P. Capitis* attacks in schools. It is thought that determining the prevalence of *P. Capitis* and the status of personal hygiene behaviors with the screenings to be made in schools will contribute to the control of *P. Capitis* attacks that are not easy to detect.

This study was planned to determine the prevalence of *P. Capitis* and the status of personal hygiene among the students, who studied in two different vocational high schools, with the screenings made.

### Materials and Method

The study was conducted with the participation of 491 students who received education at 2 different vocational high schools in Nilüfer district of Bursa province. Individuals who participated in the study were selected based on voluntariness. Students who accepted to participate in the study consisted the sample of the research.

The data collection form consists of sections in which the socio-demographic and personal hygiene characteristics and the results of louse screening were recorded. The data of the research were collected between September and December 2016 by the researchers. The data obtained from the research were transferred to the computer environment using SPSS 20.0 package software and statistical analyses were performed.

### Results

The descriptive characteristics of the students screened are given in Table 1. When the

descriptive characteristics of the students were examined, the mean age (Mean±SD) was found as 15.59±1.01 years. A total of 491 students received education at the high schools screened, 212 at Fine Arts High School and 279 at Vocational and Technical Anatolian High School. The majority of these students (80.4%) were female students. Most students' mothers were primary school graduates and fathers were high school graduates. 53.9% of the students did not receive any personal hygiene education. The prevalence of *Pediculosis capitis* among the students was found as 51.9.

According to Table 2, *Pediculosis capitis* was detected in 255 of 491 students screened. Of these students, 89 were Fine Arts High School students and 166 students were Vocational and Technical Anatolian High School students. In the comparison made in terms of the incidence of parasites, a statistically significant difference was found between the schools ( $p<0.005$ ). 71 of the 89 students with parasite at Fine Arts High School were female and 165 of the 166 students with parasite at Vocational and Technical Anatolian High School were female. The difference between the sexes in terms of incidence of *P. capiticus* was found to be statistically significant ( $p<0.005$ ).

In Table 3, a statistically significant difference was found between the behaviors of paying attention to personal hygiene, which were "I wash my hands before a meal" and "I cut my nails regularly" and the incidence of *p. capiticus* ( $p=0.013$ ;  $p=0.001$ ).

According to Table 4, a statistically significant correlation was found between the incidence of *P. Capitis* and the knowledge of students about *P. Capiticus* that were "Headscarf, cushion, cover, comb, hairbrush, and feathered small toys enable transfer", "Nits are not easily removed from the hair due to their adherence to the scalp", "Nits are the lice eggs", "Nits are in a yellowish white color", "Lice are black", "Lice are fed from blood, skin particles and lipids in the skin pores", "Lice leave eggs in the hair behind neck and ears", "Lice reproduce continuously", "Lice are parasites", "Lice are contagious" ( $p=0.007$ ;  $p=0.001$ ;  $p<0.001$ ;  $p=0.001$ ;  $p=0.012$ ;  $p=0.002$ ;  $p=0.006$ ;  $p=0.040$ ;  $p<0.001$ ).

**Table 1. Descriptive characteristics of the cases screened**

Characteristics	Mean ±Standard Deviation	N	%
Age	15.59±1.01		
Sex			
Female		395	80.4
Male		96	19.6
School			
Fine Arts High School		212	43.2
Vocational and Technical Anatolian High School		279	56.8
Class			
9th		171	34.8
10th		221	45
11th		51	10.4
12th		48	9.8
Educational level of mother			
Illiterate		14	2.9
Literate		7	1.4
Primary school graduate		169	34.4
Secondary school graduate		117	23.9
High school graduate		116	23.7
University graduate		68	13.9
Educational level of father			
Illiterate		2	0.4
Literate		4	0.8
Primary school graduate		125	25.6
Secondary school graduate		112	23.0
High school graduate		160	32.5
University graduate		88	18
Income status of family*			
Very high		59	12.1
High		254	51.7
Moderate		167	34.2
Low		11	2.2
Status of Receiving Personal Hygiene Education			
Yes		226	46.1
No		265	53.9
Prevalence of Pediculosiscapitis		255	51.9
Total		491	100

\*Students' own expressions

**Table 2. Distribution of presence of *P. Capitis* in cases screened according to school and sex**

Schools	Sex	<i>P. capitis</i> (+)		<i>P. capitis</i> (-)		Number of Students		
		Number	%	Number	%	Number	%	
Fine Arts High School	Female	71	60.1	47	39.9	118	100	<b>X<sup>2</sup>=14.808*</b> <b>p&lt;0.001</b>
	Male	18	19.1	76	80.9	94	100	
Vocational and Technical Anatolian High School	Female	165	59.5	112	40.5	277	100	<b>X<sup>2</sup>=49.391**</b> <b>P&lt;0.001</b>
	Male	1	50	1	50	2	100	
<b>Total</b>		255		236		491		

Pearson Chi-Square Test \*School \*\*Sex

**Table 3. Distribution of status of paying attention to personal hygiene in cases screened and in individuals diagnosed with *P. Capiticus***

Situations that are paid attention to personal hygiene (Yes )	Total		<i>P. capitis</i> (+)		p
	N=491	%	N=255	%	
I wash my hands when I wake up in the morning	336	68.43	168	65.8	P=0.203*
I wash my face when I wake up in the morning	396	80.6	200	78.4	P=0.189*
I wash my hands before a meal	353	71.8	171	67	<b>X<sup>2</sup>=6.232*</b> <b>P=0.013</b>
I wash my hands after a meal	394	80.2	202	79.2	P=0.544*
I change my underwear every day	352	71.6	178	69.8	P=0.364*
I cut my nails regularly	271	55.1	123	48.2	<b>X<sup>2</sup>=10.177<sup>a</sup>*</b> <b>P=0.001</b>
I wash my hands before the toilet	223	45.4	111	43.5	P=0.402*
I wash my hands after the toilet	404	82.2	203	79.6	P=0.102*
I take shower every day	74	55.8	132	51.7	P=0.06*
I take shower every other day	302	61.5	153	60	P=0.284*
I brush my teeth at least 2 times a day	348	70.8	178	69.8	p=0.581*
I do not wear the same clothes again before it is washed	302	61.5	163	63.9	P=0.251**
I take off my school clothes when I come home	352	71.6	177	69.4	P=0.208**
I wash my hands when I come home	235	47.8	118	46.2	P=0.461*
I change my bed sheet once a week	288	58.6	143	56	P=0.225*
I brush my hair every day	299	60.8	153	60	P=0.668*
I do not use hair gel, hair spray etc. for my hair	135	27.4	69	27	P=,820*

\*Pearson Chi-Square \*\*Fisher's Exact Test

**Table 4. Distribution of the relationship between the knowledge level of cases about P. Capiticus and the diagnosis of P.capiticus**

Status of Knowledge on <i>P. Capiticus</i> (Head Lice)/Nits	<i>P. capitis</i> (+)		<i>P. capitis</i> (-)		Total		p
	N (255)	%	N(236)	%	N (491)	%	
Lice can easily transfer from person to person and head to head	247	96.8	221	93.6	468	95.3	P=0.081
Close contact enables transfer	237	92.9	217	91.9	454	92.4	P=0.679
Headscarf, cushion, cover, comb, hairbrush and feathered small toys enable transfer	237	92.9	202	85.5	439	89.4	<b>X<sup>2</sup>=7.183</b> <b>P=0.007</b>
Nits are not easily removed from the hair due to their adherence to the scalp	225	88.2	181	76.6	406	82.6	<b>X<sup>2</sup>=11.578</b> <b>P=0.001</b>
Nits are the lice eggs	228	89.4	174	73.7	402	81.8	<b>X<sup>2</sup>=20.627</b> <b>P&lt;0.001</b>
Nits are in a yellowish white color	207	81.1	162	68.6	369	75.1	<b>X<sup>2</sup>=10.965</b> <b>P=0.001</b>
Lice are black	204	80	159	67.3	363	73.9	<b>X<sup>2</sup>=10.761</b> <b>P=0.001</b>
Lice are fed from blood, skin particles and lipids in the skin pores	188	73.7	150	63.5	338	68.8	<b>X<sup>2</sup>=6.283</b> <b>P=0.012</b>
Lice leave eggs in the hair behind neck and ears	211	82.7	169	71.6	380	77.3	<b>X<sup>2</sup>=9.324</b> <b>P=0.002</b>
The duration of growth of lice from eggs is 2 weeks	140	54.9	120	50.8	260	52.9	P=0.345
Lice reproduce continuously	232	90.9	195	82.6	427	86.9	<b>X<sup>2</sup>=7.705</b> <b>P=0.006</b>
Lice are parasites	198	77.6	164	69.4	362	73.7	<b>X<sup>2</sup>=4.233</b> <b>P=0.040</b>
Lice are contagious	248	97.2	211	89.4	459	93.4	<b>X<sup>2</sup>=13.064</b> <b>P&lt;0.001</b>

Pearson Chi-Square Test

## Discussion

*P. Capitis* has a cosmopolitan distribution and is common in child age groups in Turkey and in the world (Karakus et al., 2014). In the studies conducted in schools in different countries, the prevalence of *P. Capitis* has been found to be 67.3% in Iran (Soleimani-Ahmadi et al., 2017), 40.3% in Chile (Gazmuri et al., 2014), 23.32% in Thailand (Rassami & Soonwera, 2012), 20.4% in Southern Jordan (Khamaiseh, 2018), 55.3% in Jatinangor (Karimah, Hidayah & Dahlan, 2016), 25.4% in Iceland Solomon Islands (Coscione et al., 2018), 14.3% in Syria (Ismail, Kabakibi & Al-Kafri, 2018), 29.7% in Argentina (Toloza et al., 2009), 3.3% in France (Durand et al., 2007). In the studies conducted with students who received education in primary schools in our country, the prevalence of *P. Capitis* has been found as 30.4% in Hatay (Kaya et al., 2017), 12.4% in Ordu (Karaman et al., 2018), 13.1% in Kayseri (Gulgun et al., 2013), 10.2% in Sivas (Degerli, Malatyai & Mumcuoglu, 2013), 27.2% in İzmir (Karakus et al., 2014), 13.1% in Iğdır (Akkas & Cengiz, 2011), and 9.5% in Van (Dursun & Cengiz, 2010).

According to the National Pediculosis Association, the prevalence of *P. capitis* greater than 5% in the US is considered as endemic (Frankowski, 2004). In our study, the prevalence of *P. capitis* was found as 51.9% and it is thought that it should be considered as endemic.

The studies conducted in the world and in our country have shown that head louse infestation is more common in female students (Rassami et al., 2012; Balcioglu et al., 2012; Degerli, Malatyai & Mumcuoglu, 2013; Karakus et al., 2014; Kaya et al., 2017; Karaman et al., 2018; Khamaiseh, 2018; İsmail, Kabakibi & Al- Kafri, 2018). In our study, *P. Capitis* was detected in 59.7% of female students. In our study, a statistically significant difference was found between the occurrence of head louse and the sexes ( $p=0.05$ ). Our study finding is consistent with the literature.

The fact that female students have longer hair, that they are insufficient in hair care and that they share materials such as hairclips, combs, and hats may have caused this result.

It is thought that the conduction of the study in boarding schools, lack of attention to hygiene rules in communal life places, close contact between individuals, the common use of personal

accessories, clothes and bed sheets may be the factors that increased this prevalence.

In the studies conducted in Jordan and Kayseri, the prevalence of *P. capitis* has been found to be high in students with low socio-economic status and low in students with high socioeconomic status ( Akkas & Cengiz, 2011; Gulgun et al., 2013; Karimah, Hidayah & Dahlan, 2016; Khamaiseh, 2018). In the study, the prevalence of *P. capitis* has been determined to be significantly correlated with the economic status, the number of siblings and the number of rooms (Karakus et al., 2014). In our study, there was no statistically significant difference found.

In the study conducted by Karaman et al., it has been found that the prevalence of *P. Capitis* differs between schools. A similar result was obtained in our study (Karaman et al., 2018). There was a significant difference between the 2 schools. It is thought that this was originated from the differences in the cultural and economic levels of the students enrolled at Fine Arts High School.

In some of the studies conducted, it has been found that there was no statistical difference between the educational levels of fathers and the prevalence of *P. Capitis* (Akisu et al., 2003; Dursun & Cengiz, 2010); however, in some studies, there has been a negative difference found (Cetinkaya et al., 2004; Akkas & Cengiz, 2011; Gulgun et al., 2013; Khamaiseh, 2018). In the studies conducted, it has been determined that there was a correlation between the educational level of mothers and the prevalence of *P. Capitis*. In our study, there was no statistically significant correlation found. High or low educational levels of parents are among the factors that directly affect the socio-economic conditions and opportunities. The socio-economic status affects the living conditions and living areas, providing a basis for the occurrence of diseases or facilitating the spread of diseases. For this reason, it is thought that raising the educational level of family members is important in terms of the risk of diseases.

In our study, there was no significant difference found between students' status of paying attention to personal hygiene screened and the positivity of *P. Capitis*. A statistically significant difference was found between the behaviors of "I wash my hands before a meal" and "I cut my nails regularly" and the positivity of *P. Capitis*

( $p=0.05$ ). This supports the fact that bringing individuals personal hygiene habits are important in terms of preventing the spread of infectious diseases.

Conducted studies have shown that children who previously have had *P. Capitis* encounter the parasite at a higher rate than those who have never had (Degerli, Malatyai & Mumcuoglu, 2013; Khamaiseh, 2018).

In our study, a statistically significant correlation was found between students' general knowledge about *P. Capitis* (Table 4) and the positivity of *P. Capitis* ( $p=0.05$ ).

Re-experience of *P. Capitis* has increased the knowledge about this topic; however, it could have not prevented the recurrence of the disease. Therefore, it is suggested that the environment and the living conditions, as well as prevention methods, should be taken into consideration for the prevention of infection and recurrence of contagious diseases.

Previous studies and our study show that *P. Capitis* is an important public health problem. Therefore, health services should be planned very well for the prevention of contagious diseases since the high prevalence of contagious diseases is not only due to the lack of knowledge. It should be reminded that the socio-economic levels of countries or of our country are effective for such contagious diseases. In the examinations of the factors affecting the existence of *P. Capitis* in schools, the effect of sex, getting an education at a boarding school, close contact, and insufficient hygiene habits are reported. In addition to these factors, it is stated that the socio-economic level facilitated the recurrence and spread of the disease. For this reason, conditions and environments should be well examined during the screening. Training to be given at schools, raising awareness of parents and ensuring cooperation will contribute to the reduction of *P. Capitis* attacks.

## References

Akisu C., Sari B., Aksoy University, Ozkoc S., & Ozturk S. (2003). Investigation of the prevalence of *Pediculus capitis* in a primary school in Narlıdere and comparison with previous results. *Turkey Parasitology Journal*;27: 45-8. (in Turkish)  
 Akkas O., & Cengiz Z. T. (2011). The spread of head lice in some primary schools in Iğdır Province.

*Turkey Parasitology Journal*, 35, 199-203. (in Turkish)  
 Albashtawy M., & Hasna F. (2012). Pediculosis capitis among primary school children in Mafraq Governorate, Jordan. *East Mediterr Health J*, 18:43–48.  
 Balcioglu I. C., Kurt O., Limoncu M. E., Ermis V. O., Tabak T., Oyur T., Muslu H., Kavur H., Gorgun S., Girginkardesler N., Yereli K., Bilac C.,-&-Ozbel Y. (2012). Can Periodic Checks in Schools Be Enough to Reduce the Incidence of *Pediculuscapitis*? *Kafkas University Faculty of Veterinary Medicine Journal*, 18: A151-A154. (in Turkish)  
 Basarslan F., Kaya O. A., Inci M., Motor V. K., Kaya S., Sen B. B., & Yilmaz C. (2014) The Frequency of *Pediculus Capitis* in Patients Presenting to the Pediatric Neurology Outpatient Clinic. *Duzce Medical Faculty Journal*, 1: 35-37. (in Turkish)  
 Coscione S., Esau T., Kekeubata E., Diau J., Asugeni R., MacLaren D., Steer A. C., Kositz C., & Marks M. (2018). Impact of ivermectin administered for scabie treatment on the prevalence of headlice in Atoifi, Solomon Islands. *PLoS neglected tropical diseases*, 12: 1-10.  
 Cetinkaya Z., Altindis M., Kulac M., Karaca S., Piyade M. (2004) Prevalence of *Pediculuscapitis* and its treatment with Permethrin in Primary Schools in Afyon. *Turkey Parasitology Journal*; 28: 205-209. (in Turkish)  
 Daldal N., Atambay M., Aycan O. M., Karaman U., & Ersoy Y. (2004). Investigation of the prevalence of *Pediculus capitis* in two primary school children in Malatya. *Journal of Inonu University Faculty of Medicine*; 11: 11-13  
 Degerli S., Malatyali E., & Mumcuoglu K. Y. (2013). Head lice prevalence and associated factors in two boarding schools in Sivas. *Turkey Parasitoloji Journal*, 37: 32-35.  
 Durand R., Millard B., Bouges-Michel C., Bruel C., Bouvresse S., & Izri A. (2007). Detection of pyrethroid resistance gene in head lice in school children from Bobigny, France. *Journal of Medical Entomology*, 44, 796-798.  
 Frankowski B. L. (2004) American academy of pediatrics guidelines for the prevention and treatment of head lice infestation. *The American Journal Of Managed Care*, 10:269-272.  
 Frankowski B, Bocchini J. A. (2010). Clinical report-head lice. *The American Academy of Pediatrics*, 126:392–403.  
 Gazmuri P. B., Arriaza B. T., Castro F. S., Gonzalez P. N., Maripan K. V., & Saavedra I. R. (2014). Epidemiological study of Pediculosis in elementary schools of Arica, northern Chile. *Revistachilena de pediatria*, 85, 312-318.  
 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, 104
- Ozbel, Y. (2017). *Arthropod vectors and Struggle*, Parasitology Association of Turkey, Izmir, Turkey. (in Turkish)
- Ismail M. T., Kabakibi M. M., & Al-Kafri, A. (2018). Epidemiology of pediculosis capitis among school children in Damascus, Syria. *Indian Journal of Paediatric Dermatology*, 19, 331-334
- Karaman U, Bozok S. N., Erturk E., Kacmaz G., Uysal S., Bingol M., Uslu M., & Yavuz Y. (2017). Determination of Prevalence of Pediculus capitis in Ordu Primary School Students. *Inonu University Journal of Health Sciences*, 6: 1-3. (in Turkish)
- Karaman U., Engin O., Karaman O., Colak C., & Kacmaz G. (2018). Determination of head lice *Pediculus humanus capitis* prevalence among primary school students in Ordu. *Turkish Journal of Hygiene and Experimental Biology*, 75: 383-390. (in Turkish)
- Karaman U., Enginyurt O., Dundar Y., Baykal M. K., & Gur S. (2014). Socioeconomic Evaluation of *Sarcoptes Scabiei* and *Pediculus Capitis* Infestation. *Ordu University Journal of Medicine*, 1: 23-29. (in Turkish)
- Karakus M., Arici A., Toz S. O., & Ozbel Y. (2014). Prevalence of headlice in two socio-economically different schools in the center of Izmir City, Turkey. *Turkey Parasitology Dergisi*, 38: 32-36.
- Karimah A., Hidayah R. M. N., & Dahlan A. (2016). Prevalence and Predisposing Factors of Pediculosis Capitis on Elementary School Students at Jatinangor. *Althea Medical Journal*, 3: 254-258.
- Khamaiseh A. M. (2018). Head Lice Among Governmental Primary School Students In Southern Jordan: Prevalence And Risk Factors. *Journal Of Global Infectious Diseases*, 10, 11-15.
- Kaya O. A., Elmacioglu S., Onlen C., Celik E., & Zerek A. (2017). The incidence of pediculus capitis among primary school students in Hatay. *Mustafa Kemal University Medical Journal*, 8: 1-5. (in Turkish)
- Payzin, F. (1995). Head Lice Prevalences in the Primary School First Classes in the Sakarya Söğütlü Dispensary Region. *Turkey Clinical Journal of Medical Sciences*, 15: 57-60. (in Turkish)
- Dursun N., & Cengiz Z. T. (2010). The spread of head lice in the Erciş district of Van. *Turkey Journal of Parasitology*, 34: 45-49. (in Turkish)
- Rassami W., & Soonwera M. (2012). Epidemiology of pediculosis capitis among school children in the eastern area of Bangkok, Thailand. *Asian Pacific Journal of Tropical Biomedicine*, 2: 901-904.
- 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: 1-6.
- Toloz A., Vassena C., Gallardo A., González-Audino P., & Picollo M. I. (2009). Epidemiology of Pediculosis capitis in elementary schools of Buenos Aires, Argentina. *Parasitology research*, 104: 1295-1298.