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The prevalence of pediculus capitis in primary schools in a city of Turkey and the efficacy of health education in treatment

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Abstract

Pediculus capitis (PC) is still a world-wide health concern. To identify the prevalence of PC and to evaluate the efficacy of training of mothers about PC in treatment. Design: The study consists of two sections: First section is cross sectional and second section is randomized controlled trial which was conducted between October 3, 2016 - Jun 5, 2017. Sixty children who had parasites were randomized into the intervention and the control groups. Mothers in the intervention group were given education about PC through home visits. There were one in every 10 children in PC. The prevalence of parasites was high in girls, children with four/ more siblings, those with low income, and and those whose mothers have low education levels ($p<0.05$). Training to the mothers didn't affect the effectiveness of the treatment while increasing knowledge. Pediculus capitis is still prevalent. Social determinants are influential in PC infestation. Training given mothers about PC couldn't provide additional benefits to the treatment.

Keywords: Pediculus capitis, health education, primary school children, school health

Introduction

Pediculus capitis (PC) as known head lice is a parasitic disease which is common among students, primarily those aged 3-11 years [1,2]. Lice infestation which dates back to 25 million yeras ago is still preavalent around the world, regardless of level of development [3]. Of the countries with a very high level of development, the prevalence of PC is 1.59% in Poland and 61.4% in Argentina. Of the countries with high level of development, the prevalence of PC is 6.85% in Iran and 23.32% in Thailand; of the countries with medium level of development, the prevalence of PC is -1.8% in Pakistan and -16.59% in India; of the countries with low level of development in which high prevalence rates are expected, the prevalence of PC is 1.3% in Nigeria and 13.3% in Yemen [4–11]. School inspections for lice in Turkey demonstrated that the prevalence of PC varied between 5.6% -35.4% from 1980 to 2000 and the prevalence of PC decreased to about 14% from 2010 to today [12–16].

Even though there is data indicating that lice are more common among poor people, PC can affect almost every social class. Schools, which are ideal places for the spread of the disease, facititate the transmission of lice from one student to another through contact, and other risk factors include long hair length, female sex, age, high number of siblings, parents with low education level, living in a rural environment, low income level and living in places with insufficient saeggation [1,14,17,18].

PC with its capability of reproducing quickly, is an ectoparasite. It is placed close to the scalp and is firmly attached to the hair shaft. The egg becomes nymph leaving its shell 6-9 days after incubation, and turns into adult 7 days later. PC feeds on blood to survive and the irritation at the spot it stings causes itching and dermatitis. Pediculicides used for the treatment are unable to kill all stages of the egg, the drug should be repeated after new lice leave their shells [19,20]. Today despite the use of powerful insecticides, and prodigious efforts of parents and healthcare providers, successful control of PC remains difficult to attain [2,21].

Materials and Methods

The first section of the study which aimed "to identify the prevalence of PC in primary schools" was sectional whereas the second section which aimed to evaluate "the efficacy of the mothers'education in the treatment of PC" was interventional. The sample of the cross-sectional study was calculated with Epi Info

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Programme as 383 by taking into account the number of students in primary schools in Mersin [120.588], the parasite prevalence of 50%, the confidence interval of 95% and the error margin of 5%.

Primary schools in regions with low socioeconomic status were chosen as a research area. Low socioeconomic regions identified based on land prices determined by the Ministry of Finance vary between 1 and 220 ₺ (Turkish Liras)/m2 in the city. Regions with a land price of 20 ₺/m2 or less were evaluated as "regions with low socioeconomic level". A list of 72 primary schools in the "socioeconomic low regions" was established among 104 state schools located in the city center. These schools are ranked according to the randomisation created on the computer. Accordingly, the students from the first three primary schools were included in the screening. The population of the study consisted of 1205 students who were permitted to undergo a physical examination by the parents (Figure 1). Data were collected in two periods, between 03.10.2016 and 03.04.2017.

The population of the interventional study consisted of the students in whom lice were detected through the examination of hair. The study conducted between 13.03.2017 and 05.06.2017 sample was identified using G*Power Statistical Program. Based on the study by Gholamnia et all. [1], it was assumed that each group should have 21 individuals with the power being 0.90 and α =0.05 and, considering the possible losses, the total number was set as 60. In proportion to the number of children who had lice/eggs in schools in the first semester, the number of students that would be taken from each school was identified and the children with parasites were randomized to the intervention and the control groups according to a computer-generated randomization table. The study was completed with 48 individuals (Figure 1). The parents were'nt informed about the group they were assigned.

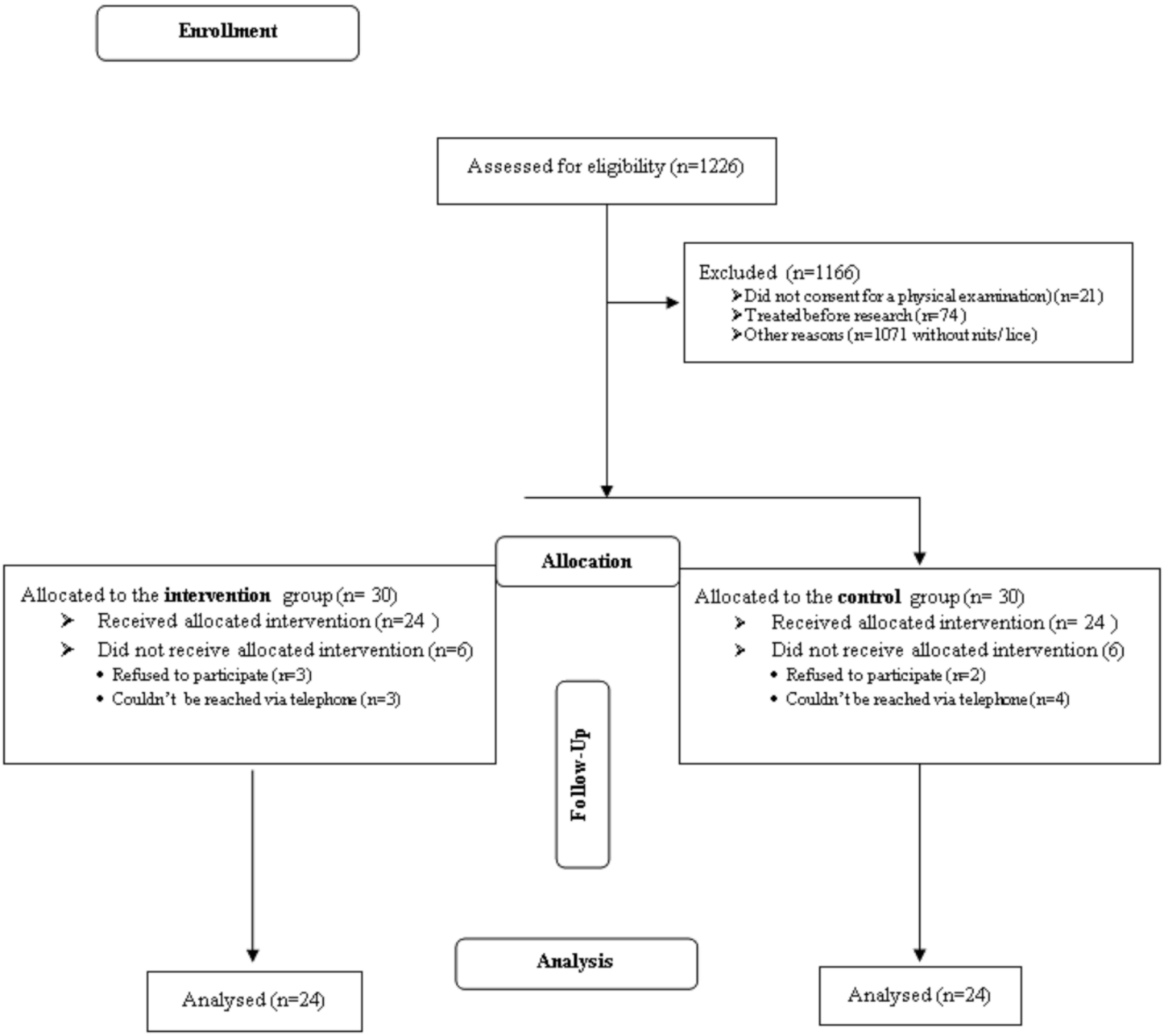

Figure 1. Flow diagram of the study population

In the first section, a student examination permission form was sent to the parents by the class teacher. The students were examined one by one by the researchers in a well-lighted room. During the inspection, the hair was divided into four sections and the scalp from the nape of the neck to the forehead and hair were visually checked for lice and/or eggs for about 3 minutes by using a magnifying lens when needed [1,22]. In order not to lose the louse or the egg, the hair was combed starting from the scalp to the end of the hair using a fine-toothed comb. The eggs were accepted as "live eggs" if they were 1 cm to the scalp, white/honey in color, bright and attached to the scalp whereas pale-colored eggs that could be removed from the hair easily were accepted as "dead eggs". Data provided from the examination such as the sites where PC/eggs were found and the mean number of live/dead eggs/eggs for each site, length of hair, hair type were recorded in a form.

In the second section, the parents of the students with parasites were reached via telephone by the teachers and informed about the situation. The parents in both groups were told that a research on lice and protection from lice was being conducted and that, on a voluntary basis, some questions were going to be addressed in order to organize the content of the education that would be provided and a 25-item questionnaire that would take 3 minutes to complete was administered. The first section of the questionnaire consisted of introductory characteristics of parents whereas the second section included 10 statements to be answered true/false which were developed based on the studies [23,24]. These statements focused on well-known myths about PC.

In the third section, parents in the intervention group were told that they would be given education about the issue. The 35-minute education program whose content was prepared by the researchers was given to the parents in their homes or at school according to their preferences. Parents were also provided with brochures explaining how to protect against lice and how to remove lice and eggs from hair.

The content of the education included risk factors for pediculosis, identification of lice and eggs in hair, spots where lice tend to hide in hair, signs and symptoms, methods of removing lice and eggs and precautions for protection from lice. At the end of the education, the questionnaire about lice was repeated in the intervention group.

In the last section, hair of the students in both groups was checked the presence of live/dead lice/eggs on days 14 and 30 of the inspection. At the end of the study, parents in the control group were sent written education content and brochures via students and 30-minute overall hygiene education that included hair cleaning and control of head lice were given all of the students.

Statistical analysis

Data were analysed using SPSS version 21.0 (IBM Corp.,Armonk, New York, USA) using percentage, arithmetic mean, median, 25-75% percentile as the descriptive statistics, the Shapiro Wilks test for normal distribution, the independent t test, the Mann-Whitey U, the Wilcoxan Signed Ranks and the Chi square test as the significance tests.

Ethical considerations

Prior to the study, the approval of the Ethics Committee of Mersin University (2017/05) and Provincial Director of National Education was obtained. Administrators and teachers of the schools were informed about the study. A written consent was obtained from parents of the children who would undergo lice inspection whereas a written/oral consent was obtained from parents with whom the interventional study would be performed.

Results

Of a total of 1205 students, 134 (11.1%) had eggs and 5 (0.04%) had lice in their hair. Of a total of 1102 mothers, 792 (71.9%) had a primary education or lower. The risk of eggs in hair of the students whose mothers had a primary education or lower was 0.64 times higher than that in the students whose mothers had an education above primary level ($p=0.05$) [OR=0.641 (0.407-1.009)]. Of all fathers, 641 (58.0%) had a primary education or lower. The presence of eggs in children did not differ according to the level of education of the fathers ($p>0.05$).

The comparison of the prevalence of PC according to age revealed that 61 (45.5%) of the children with lice and eggs in their hair were in the 6-7 age group, 10 (7.5%) were in the 10-12 age group; there was no statistically significant difference in the prevalence between the age groups. Of the students who had fewer than 3 siblings, 82 (9.5%) had eggs in their hair, whereas, of those who had 4 or more siblings, 51 (18.3%) had eggs in their hair. The risk of the presence of eggs in children with four or more siblings was 2.13 times higher than that in children with three or fewer siblings. Of a total of 1067 students who had information about the balance of income and expenses, 349 (32.7%) had income lower than expenses, 619 (58.0%) had income equal to expenses and 99 (09.3%) had income higher than expenses. Of parents whose children had eggs in their hair, 55 (44.4%) had income lower than expenses, 57 (46.0%) had income equal to expenses and 12 (09.7%) had income higher than expenses. There was a relationship between the status of PC and the perception of income as high or low ($p<0.01$).

The results of the intervention study evaluating the efficacy of health education in the treatment of lice demonstrated that the mean age of the students was 7.5± 1.35 (5-10) years in the intervention group, 7.46± 1.56 (5-12) years in the control group. There were 21 females and 3 males in the intervention group; 23 females and 1 male in the control group. The mean family income was 1147.37± 422.12 (300- 2000) ₺ in the intervention group and 1483.33± 941.37 (500-4500) ₺ in the control group. Mothers of 20 (41.7%) children in the intervention group and 17(35.4%) children in the control group had a primary education or lower. There were parasites in parents of 6 children in the intervention group and 1 in the control group whereas 13 in the intervention group and 14 in the control group had parasites previously. No difference was noted in age, sex, income, education level of mother, number of siblings, number of family members, number of rooms in the house and previous history of parasite between the groups ($p>0.05$) whereas there was a difference in terms of the presence of parasite in the family ($p<0.05$) (Table 1). Thirty eight of the children (79.2%) who had eggs in their hair had medium length hair and long hair, 10 (20.8%) had short hair; 42 (87.5%) had straight hair.

It was found that eggs were most numerous in the retro-auricular and occipital regions in both groups before the intervention and the number of eggs per region was highest in these regions; that there were live eggs in the parietal-temporal and occipital regions in both groups on day 14 and there was a low number of live eggs in the retro-auricular, occipital and frontal regions in the control group alone on day 30 (Table 2).

Table1. Distribution of the identification characteristics of the groups

Characteristics		Intervention group n (%)	Control group n (%)	p
Mother's Education Level	Primary school or below	20 (%41.7)	17 (%35.4)	0.30
	Above Primary school	4 (%8.3)	7 (%14.6)	
Number of siblings	3 or below	13 (%27.1)	15 (%31.2)	0.56
	4 or above	11 (%22.9)	9 (%18.8)	
Number of person in the family	5 or below	15 (%31.2)	18 (%37.5)	0.35
	6 or above	9 (%18.8)	6 (%12.5)	
Number of rooms in the house	3 or below	7 (%14.6)	9 (%18.8)	0.54
	4 or above	17 (%35.4)	15 (%31.2)	
Presence of parasite in the family	Yes	6 (%12.5)	1 (%2.1)	0.04
	No	18 (%37.5)	23 (%47.9)	
Previous history of parasite	Yes	13 (%27.1)	14 (%29.2)	0.77
	No	11 (%22.9)	10 (%20.8)	

Table 2. Distribution of eggs on the groups

		Pediculus capitis infestation n/ %								
		Pre-intervention			Post-intervention					
					On 14th day			On 30th day		
Sites	**Number of alive eggs according to regions of hair**	**Intervention Group**	**Control Group**	**Total**	**Intervention Group**	**Control Group**	**Total**	**Intervention Group**	**Control Group**	**Total**
Frontal	0	16/66.7	15/62.5	31/64.6	22/91.7	19/79.2	41/85.4	24/100	22/91.7	46/95.8
	1-2	1/4.2	2/8.3	3/6.2	0/0.0	2/8.3	2/4.2	0/0.0	1/4.2	1/2.1
	3-4	3/12.5	3/12.5	6/12.5	1/4.2	0/0.0	1/2.1	0/0.0	1/4.2	1/2.1
	5-6	2/8.3	2/8.3	4/8.3	0/0.0	3/12.5	3/6.2	0/0.0	0/0.0	0/0.0
	7-10	1/4.2	0/0.0	1/2.1	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0
	Above 10	1/4.2	2/8.3	3/6.2	1/4.2	0/0.0	1/2.1	0/0.0	0/0.0	0/0.0
Paryatotemporal	0	13/54.2	10/41.7	23/47.9	20/83.3	18/75.0	38/79.2	24/100	24/100	48/100
	1-2	1/4.2	1/4.2	2/4.2	1/4.2	1/4.2	2/4.2	0/0.0	0/0.0	0/0.0
	3-4	5/20.8	5/20.8	10/20.8	1/4.2	1/4.2	2/4.2	0/0.0	0/0.0	0/0.0
	5-6	0/0.0	1/4.2	1/2.1	0/0.0	2/8.3	2/4.2	0/0.0	0/0.0	0/0.0
	7-10	1/4.2	1/4.2	2/4.2	1/4.2	1/4.2	2/4.2	0/0.0	0/0.0	0/0.0
	Above 10	4/16.7	6/25.0	10/20.8	1/4.2	1/4.2	2/4.2	0/0.0	0/0.0	0/0.0
Oksipital	0	6/25.0	6/25.0	12/25.0	20/83.3	17/70.8	37/77.1	24/100	20/83.3	44/91.7
	1-2	0/0.0	1/4.2	1/2.1	1/4.2	2/8.3	3/6.2	0/0.0	2/8.3	2/4.2
	3-4	5/20.8	3/12.5	8/16.7	2/8.3	1/4.2	3/6.2	0/0.0	1/4.2	1/2.1
	5-6	1/4.2	2/8.3	3/6.2	0/0.0	2/8.3	2/4.2	0/0.0	0/0.0	0/0.0
	7-10	5/20.8	4/16.7	9/18.8	0/0.0	1/4.2	1/2.1	0/0.0	0/0.0	0/0.0
	Above 10	7/29.2	8/33.3	15/31.2	1/4.2	1/4.2	2/4.2	0/0.0	1/4.2	1/2.1
Retro-auricular	0	4/16.7	3/12.5	7/14.6	22/91.7	19/79.2	41/85.4	24/100	22/91.7	46/95.8
	1-2	1/4.2	6/25.0	7/14.6	1/4.2	1/4.2	2/4.2	0/0.0	1/4.2	1/2.1
	3-4	6/25.0	0/0.0	6/12.5	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0
	5-6	2/8.3	2/8.3	4/8.3	0/0.0	3/12.5	3/6.2	0/0.0	1/4.2	1/2.1
	7-10	4/16.7	4/16.7	8/16.7	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0	0/0.0
	Above 10	7/29.2	9/37.5	16/33.3	1/4.2	1/4.2	2/4.2	0/0.0	0/0.0	0/0.0

The evaluation of the presence of lice/eggs in the groups before and after the intervention showed that there were no live eggs in 18 (75.0%) students in the intervention group on post interventional day 14 whereas there were no live eggs in 16 (66.7%) students in the control group; there were no live eggs in the intervention group whereas 4 (16.7%) students in the control group had live eggs on day 30. There was no difference in terms of the presence of live eggs between the groups (p>0.05) (Table 3).

The evaluation of the level of knowledge of the intervention and control groups about "characteristics of lice, transmission and ways of protection" revealed that before the intervention, the median knowledge score of two groups was 5.00 (4.00- 6.00); 5.00 (3.25-6.00) in intervention group and 5.00 (5.00-6.00) in control group. Before the intervention, median knowledge scores wasn't difference between the groups (p= 0.06) whereas after the intervention, knowledge score was significantly improved in the intervention group 7.00 (5.25- 8.00); p<0.01) (Table 4).

Table 3. Distribution of alive and dead eggs on the 14th and 30th day on the groups

		On 14th day				On 30th day			
		Intervention Group	Control Group	Total	p	Intervention Group	Control Group	Total	p
Alive eggs	Yes	6 (%12.5)	8 (%16.7)	14 (%29.2)	0.53	0 (%0)	4 (%16.7)	4 (%8.3)	0.11
	No	18 (%37.5)	16 (%33.3)	34 (%70.8)		24 (%100)	20 (%83.3)	44 (%91.7)	
Dead eggs	Yes	13 (%54.2)	14 (%58.3)	27 (%56.2)	0.77	6 (%25)	9 (%37.5)	15 (%31.2)	0.35
	No	11 (%45.8)	10 (%41.7)	21 (%43.8)		18 (%75)	15 (%62.5)	33 (%68.8)	

Table 4. Results from "true/ false" questions

Questions	Correct responses %		
	Intervention group		
	Before the education	After the education	Control group
Head lice can jump (false)	25.0 (6/24)	70.8 (17/24)	37.5 (9/24)
Lice can protect its vitality for a few days when it is away from the head (false)	37.5 (9/24)	66.7 (16/24)	50.0 (12/24)
People with head lice constantly scratch their hair (false)	4.2 (1/24)	12.5 (3/24)	8.3 (2/24)
Lice can live in a hat or on carpet (false)	50.0 (12/24)	62.5 (15/24)	62.5 (15/24)
Lice shampoo or lotion for therapy should be used two applications 7 days apart (true)	54.2 (13/24)	95.8 (23/24)	83.3 (20/24)
Some products kill all the eggs at once (false)	54.2 (13/24)	83.3 (20/24)	45.8 (11/24)
Head lice switch from hair to hair (true)	91.7 (22/24)	100 (24/24)	100 (24/24)
The whole house must be thoroughly cleaned if head lice are found (false)	16.7 (4/24)	25.0 (6/24)	12.5 (3/24)
Head lice prefer clean hair (true)	70.8 (17/24)	75.0 (18/24)	58.3 (14/24)
Gas oil shouldn't be used to get rid of lice (true)	58.3 (14/24)	70.8 (17/24)	87.5 (21/24)

*Correct answers were showed besides the sentences in parenthesis in first column

Discussion

The prevalence of PC found in this study is similar to that in other studies conducted after 2010 in our country [12-16]. When the results are compared to other regions of the world, the prevalence of PC in our study is higher than the global prevalence of less than 10%, lower than the prevalence rates of 15% in Asia, 44% in South America and 59% in South Africa and similar to the prevalence rate of 13% in Europe [22,25].

A literature review revealed no linear relationship between level of development and the presence of parasites [6-11]. These results indicate that climatic characteristics such as temperature, humidity, seasonal changes [16,18] and geographic conditions play a major role in the transmission of PC, while also emphasizing the social inequalities within countries themselves [14,26].

Most of the studies suggest that social factors that determine health can be effective in PC infestation. Studies demonstrated that the prevalence was significantly higher in people living in rural areas, children with an unemployed father, particularly when mother was illiterate, fewer than 3 rooms, absence of water supply, crowded household, low income [14-16,18,27,28]. In this study, the high prevalence rate associated with mothers' low education level, low income, and 4 or more children sharing limited income within the same house demonstrates the importance of social factors in PC infestation, which is consistent with previous studies.

It has been reported in the literature that primary school children constitute a high risk group due to close contact with each other [1,21] , with the highest incidence occurring between ages 5 and 12 [1,6]. Even though there are several studies indicating that the prevalence changes with age in this group there are other studies suggesting that the prevalence does not differ with age, similar to our study.

One of the indisputable risk factors in the literature is female sex. In studies conducted in our country, the male to female ratio for lice infestation ranges between 1:3.8 [15] and 1:29. [14-16] The female dominance can be attributed to the fact that girls play games that require closer contact in smaller groups. In addition, previous studies suggested that the infestation was more common in individuals with medium or long hair compared to those with short hair [29]; the prevalence of PC remains low since the eggs attached to short hair can not stay long on the hair strand [16]. It has also been suggested that the infestation of head lice is associated with the type of hair. The prevalence of pediculosis was higher in people with curly hair than that in those with straight hair [15].

In the context of this study, children in whose hair lice and eggs were detected were not excluded from school, whereas, their parents were informed. The health authorities in the USA, Canada, and Australia recommend immediate exclusion of children with lice/eggs in their hair from school according to the "no egg" policy [29]. However, if the eggs located closer than 2.5 mm from the scalp is an indicative of active pediculosis, infestation doesn't occur in the majority of children [24]. This study demonstrated that PC/ eggs are commonly located in the retroauricular, occipital, parietal-temporal and, less commonly, frontal regions of the scalp, which is consistent with the literature. On the other hand, it is still to be elucidated yet why lice prefer these regions to lay their eggs [22].

Aktürk et al. (2012) reported treatment success rate as 66.0% after a two-week follow up program in children with parasites in their hair [15]. In this study, treatment success rates were higher than those reported in the literature. It can be concluded that the family application and the follow ups had positive effects on the groups.

A study conducted in Turkey reported that 10.9% of children with parasites in their hair experienced repeated infestations of parasite and the treatment failed in 80.0% of these children [15]. The history of repeated parasite infestations in about half of children with eggs in their hair and the continuation of PC problem in 4 of children in the control group at the end of the study are important in drawing attention to the obstacles and challenges encountered in the treatment and prevention of head lice.

Similar to a study conducted in Australia, myths about head lice are common among mothers in Turkey [23]. These myths themselves constitute obstacles to the diagnosis and treatment of and protection from PC. For example, mothers are unaware of the fact that, with the first infestation, itching may not develop for 4-6 weeks because it takes time to develop a sensitivity to louse saliva, which delays the diagnosis and treatment and can facilitate the spread of PC in crowded places [24]. The common belief that only one application of the drug would suffice in the treatment of PC compromises the efficacy of treatment, thus resulting in the development of resistance. Studies suggested that comprehensive information campaigns should be undertaken to ensure effective control of PC and children and parents should be reached through health screening programs. The results of this study are also supportive of these suggestions [1,14].

Conclusion

In conclusion, PC is a public health concern that can be prevented despite its prevalence in society and the effect it creates. A study conducted in Europe suggests that the absence of a nurse in schools is associated with increased PC risk, whereas, employing nurses can reduce this risk by half [30]. On the other hand, nurses are not employed in most public schools, except private schools, in Turkey. This study demonstrated that the presence of a nurse in regions, particularly with low income level constituting a high-risk group, can ensure success in the diagnosis and treatment of PC.

Future studies which will implement interventions, embracing the whole school commueggy, to prevent PC which causes social stigma among children and evaluate the efficacy of health education to be conducted through home visits particulary in children with repeated PC and in case of the failure of PC treatment are warranted.

Limitations of study

The study was conducted only with children in three primary schools due to time and budget limitations, therefore, the study results are limited to the sample group. The use of visual inspection alone in the diagnosis of PC and unevaluated drug use though the efficacy of drugs can vary in the treatment of PC are important limitations of this study.

Competing interests
The authors declare that they have no competing interest.

Financial Disclosure
There are no financial supports

Ethical approval
Prior to the study, the approval of the Ethics Committee of Mersin University (2017/05)

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